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BURLINGTON ORTHODONTIC
RESEARCH CENTRE

Progress Report Series

No. 3

1957 to 1958

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Division of Dental Research

Faculty of Dentistry

University of Toronto

November, 1958

BURLINGTON ORTHODONTIC

RESEARCH CENTRE

Report Series No. 3

ANNUAL MEETING

November 20, 1958

439A Brant Street, Burlington

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TORONTO

Research Division

Faculty of Dentistry

University of Toronto.

CONTENTS

	Page
Program of Annual Meeting	1
List of Staff Members	2
Activities for 1957-58	3
Records and Treatment	5
Classification	6
Explanatory Notes for Landmarks and Measurements	45
Genetic Studies	60
P-A Analysis	81
Occlusal Plane as Related to Age and Occlusion	84
Studies in Progress	85
File of Data	87
Budget	91

PROGRAM OF
ANNUAL MEETING

439A Brant Street, Burlington

10:00 A.M., Nov. 20, 1958.

- I Introductory Remarks (Dr. G. Nikiforuk)
- II Review of Year's Progress (F. Popovich)
- III Report on Orthodontic Workshop Participation
by various staff members - Drs. Grainger and Hatton
- IV Comments by the Head of the Department of Orthodontics
(Dr. E. Harvold)
- V Open Discussion.

This publication comprises the third in the report series on the Burlington Orthodontic Research Centre for presentation at the Annual Meeting. Public Health Project 605-1-20.

STAFF

The staff members have maintained their same work assignments as described in the Report Series No.2. This year Dr.Albert Jarvis, Orthodontist, has joined the staff and Dr.R.Boyko has reduced his time due to pressure from his private practice. The staff members for the 1957-58 work session have been:

Position	Name	Address
Director	Dr.F.Popovich (Orthodontist)	Burlington, Ontario
Geneticist and Lecturer	Dr.Margaret Hatton	Zoology Department, University of Toronto
Clinic Assistant and Technician	Mrs.M. Holbrook	Burlington, Ontario
Dental Assistant and Stenographer	Mrs.K.L.Scarlett	Burlington, Ontario
Orthodontist	Dr.R.Boyko	Toronto, Ontario
Pedodontist	Dr.W.Feasby	Hamilton, Ontario
Orthodontist	Dr.M.Johnston	Hospital for Sick Children, Toronto
Orthodontist	Dr.Bruce Morrow	Hamilton, Ontario
Pedodontist	Dr.L.Scott	Brantford, Ontario
Statistician and Research Consultant	Dr.R.M.Grainger	Ontario Department of Health

Dr.G.Nikiforuk, Chairman of Division of Dental Research has continued to advise on Administration Policy.

HIGHLIGHTS OF ACTIVITIES FOR 1957-58

1. A major effort was made to complete the classification of 1200 control cases yielding the first comprehensive picture of malocclusion as it occurs in a typical community, see Table II.
2. Standard tracings were completed from the lateral head plates (figure 1) of the control cases and measurements from these tracings have been consolidated into a special ledger to serve as the basis of future research.
3. Orthodontic treatment was carried on for 137 children while 42 children are under supervision in conducting serial extractions and occlusal grinding. Thirty-nine children undergoing appliance therapy have finished treatment. Of this number five will require further treatment at a later stage of development.
4. Approximately 450 sets of full records were taken and processed.
5. A paper was prepared by the staff and read by Dr. Grainger at the Kellogg Foundation Orthodontic Workshop held at Ann Arbor, Michigan, June, 1958. This paper is to be included in the transactions of the workshop which will be published by the C. V. Mosby, Company. The paper gives a comprehensive summary of material published in Report Series No. 1, 2 & 3. Five staff members attended the Workshop and took part in committee work.
6. A paper was read at the Joint Convention of the Canadian Public Health Association, and West Coast Division of the American Public Health Association in Vancouver, British Columbia, May, 1958. We are grateful to Dr. M. Jarrett, Dental Health Director, Wellington & Halton Counties for reading this paper.

7. A paper was read at the Eastern Ontario Public Health Conference held in Oshawa, February, 1958, by Dr.R.M.Grainger.
8. A paper was read at a regular meeting of the Toronto Orthodontic Study Club on the night of November 6th,1958,by Dr.F.Popovich.
9. Tabulated data was included and distributed at a Seminar on Dentistry for the Pre-School Child, at the Annual Convention of the Canadian Society for Dentistry for Children in Niagara Falls, May, 1958, by Dr. Grainger.
10. An exhibit was presented by Dr.Margaret Hatton on genetic studies emanating from Burlington, at the tenth International Congress on Genetics in Montreal, August, 1958,
11. A paper was read at the Ontario Public Health Association Convention at the King Edward Hotel, September, 1958, by Dr.F.Popovich.
12. A paper "Reliability of Measurements from Cephalograms: An evaluation of Experimental Error from Radiographic and Tracing Technique at the Burlington Orthodontic Research Centre" by M.Hatton and R.M.Grainger was published in the October issue of the Journal of Dental Research.
13. A staff luncheon was held in July,1958, at the Estaminet House in Burlington. Various informal reports were received and discussion was held regarding the work of the past year and future projects.

REVISION OF THE NUMBER OF ACCUMULATED TREATMENT
DEMONSTRATION RECORDS

Work of treating and gathering records on the serial group has progressed and in addition 165 longitudinal control records are available at 9 years of age for those children who were 6-year-olds in the initial control data. About 200 sets of records are also now available for the parents of the serial group children.

TABLE I

Age and Sex Distribution of Serial Group for Whom
Annual Records are on File and for whom Necessary Treatment
is Underway.

Sex	3 yr	4yr*	5 yr	6yr	7yr	8 yr	9 yr	10 yr
Males	134	163	160	147	118	43	2	
Females	104	140	138	132	117	53	2	
Total	238	303	298	279	235	96	4	

* 64 four-year olds were added to the initial group to ensure that the demonstration group would have more adequate number.

TREATMENT LOAD

The treatment load for the past year has been somewhat lower than previous years perhaps in part due to a shift in types of cases. The (137) children under active treatment during the current year were mainly space retaining, mono-blocks, and labio-lingual type cases. Thirty-nine children of the active treatment group have been finished. Only five of these will probably require further treatment during a

later stage of development. An additional 42 children are under supervision for occlusal adjustments and serial ~~ex-~~ extractions. These cases are reviewed regularly at bi-monthly staff meetings. It may be that as the serial group advances into the mixed dentition stage, more complex conditions will arise in keeping with the malocclusion prevalence for the older control groups (see Table IV, page 42) However it is hoped, and there is already cause to expect, that the regular care given these children at an early age will prove so beneficial that the number of cases and variations of malocclusion in the demonstration generation will remain low. This question is a major objective of the study and will be reported in due course.

CLASSIFICATION AND ARRAY OF CLINICAL MANIFESTATIONS
OF MALOCCLUSION AT AGES 3, 6, 8, 10 & 12 YEARS.

The classification and listing of clinical variations in malocclusion and related factors as introduced in Report Series No. 2. was completed for the 1200 control cases (see Table II, 26 pages). In the conduct of this work it was found desirable to slightly expand the classification system and hence also the classification work form. The revised classification scheme follows on page 12 and the new form on page 14.

As was pointed out in Report No. 2, Group I and II defects compose the actual malocclusion manifestations

whereas group III and IV conditions are predisposing factors⁷ or complications of a general nature influencing the prognosis or treatment plan. It may be seen from summary Table III that 10.4, 17.5, 8.7 and 6.5% at age 3, 8, 10 and 12 years were reported to have only Group III and IV defects. (The figure for age six is not reliable because it was the initial age experimentally classified and we feel that some items, especially anterior overjet, were under-estimated.) The predisposing tooth defects Group III are not preventable with the exception of a portion of the dental caries, but the malocclusions which may result seem likely to be intercepted if the appropriate steps are taken before complications occur. Also the Group IV general conditions are recognized early and the appropriate steps taken. Thus for example a child who is mouth breathing may have his adenoids removed before any actual malocclusion appears and again a child with a sucking habit may be encouraged to stop before tooth displacement has resulted. This is surely preventive orthodontics and should be the concern of general practitioners as well as orthodontists.

From these preliminary tabulations (Table III) it is clear that although the theoretical number of combinations of the approximate dozen physical manifestations of malocclusion and the two dozen qualifying factors is astronomical the actual numbers of different variations of malocclusion were

actually only 38, 36, 55, 95 and 110 at ages 3, 6, 8, 10 and 12 years respectively and many have only slight differences. This knowledge should simplify the problem of recommending or teaching case management because there is a limited number of different situations to be met at any age. Conclusions regarding treatments finally recommended by the committee will, it is hoped, be eventually inserted at each age under the classifications of the general listing. This final report on treatment recommendations for specified classifications may lead to a more scientific approach to orthodontic treatment prescription since it would seem that much of the dissension that occurs between orthodontists may be due to the fact that they are often not quite talking about the same case. The treatment recommendations for any specific type of case may be constantly refined as the result of research and it is felt that these new findings could be consolidated every five years by an Orthodontic Workshop convened for the purpose of revising an official treatment manual. This method of integrating orthodontic research with practical experience should lead to a more rapid advancement in case management and teaching.

Finally with reference to epidemiology as applied to the study of malocclusion, we wish to point out how the knowledge of the frequencies of specific manifestations of malocclusion with age, or according to the presence of other

~~infects will make possible a more accurate classification~~ ²
over

occlusion defects will make possible a better understanding of the etiology of occlusion defects. Table IV is not presented as if it contained final conclusions (the rates for Class III occlusions are based on only a few cases hence subject to large sampling error), but because it illustrates the type of material which will be possible to be built up from the complete listing of this community's malocclusion, Table II. A few comments will demonstrate the great potential of the epidemiological approach to malocclusion and the future value of the data being collected.

- a) Posterior crossbites appear at a fairly constant rate in the Class I and Class II cases over the five age groups suggesting that this defect develops early and is not self-correcting.
- b) Anterior open-bites may be more frequent at pre-school ages for Class I cases. The high rate for Class III cases is probably a sampling artifact.
- c) Active sucking habit[?] prevalence increases greatly as we pass from normal occlusion cases to Class I and Class II cases. This is in agreement with an earlier study conducted at this research centre (see Report Series I) on the sucking problem. The detailed study showed that all the Class II and Class I cases with a history of active sucking have greater average maxillary denture protrusion than the normal occlusion cases. The non-

sucking Class II cases were distinguished by smaller than average mandibles, and larger than average maxillae, Table VI. In other words a non-habit Class II can be as a result of an average size mandible and greater than average maxilla or an average size maxilla and a smaller than average mandible. If the thumb or finger sucking is stopped before 6 years of age most of the deformity resulting from the habit resolves by itself unless the buccal segments have become locked by cusp relations.

- d) Mid-line diastema is very rare in deciduous dentition and in the permanent dentition it decreases with age as the lateral and cuspid teeth erupt.
- e) Rates for premature loss of deciduous teeth for the control groups are of little value after age 10 years. However for the younger ages tooth loss is not apparently correlated to anterior posterior denture relation and hence leads equally to mutilation of all types of occlusion.
- f) Adenoids decrease in frequency with time principally as results of surgical removal and to a slight extent of natural atrophy.
- g) The correlation between the dental and the skeletal anterior posterior relation is remarkably high. Almost 90% of those with normal denture relation also have an a/b skeletal relation within the range +3 mm to -1 mm. The

number of dental Class II or dental Class III cases with a Class II or a Class III underlying skeletal condition is about 60%. This indicates that although the dental antero-posterior relation may be abnormal without an underlying skeletal defect it is quite rare to find normal dental relation in the presence of a faulty skeletal growth pattern.

Revised Classification of Malocclusion Manifestations and Related Conditions.

Code Sex and Age

I Antero-Posterior Denture Relation (cuspid, molar relation)

- (N)) Dental neutroccclusion
- D) Dental distocclusion, half cusp displacement.
- D+) Dental distocclusion, full cusp displacement.
- M) Dental mesiocclusion, half cusp displacement.
- M+) Dental mesiocclusion, full cusp displacement.
- U) Unilateral

II Position of Teeth

- P1 Anterior crossbite (i.e. negative overjet).
- P2 Posterior crossbite with maxilla to lingual, (if buccal P2b).
- P3 Upper incisor overjet to lower incisor exceeding 3mms.
- P4 Lower incisor tip to upper incisor(lingual) exceeding zero.
- P5 { Overbite exceeding 1/2 lower incisor crown.
- P6 { Openbite exceeding zero.
- P7 Open contacts in upper permanent teeth exceeding 3 mms.
- P8 Open contacts in lower permanent teeth exceeding 3 mms.
- P9 Mid-line diastema in upper exceeding 2 mm.
- P10 Simple malposition of one or more teeth to the extent of interfering with function but where there is room for correction, e.g. rotations, ~~or single tooth crossbites.~~
- P11 Crowding out of position of one or more upper teeth and where 3 mms. or more space would have to be made for correction.
- P12 Crowding out of position of one or more lower teeth and where 3 mms. or more space would have to be made for correction.

III Tooth Defects Influencing Occlusion.

- T1 Premature loss of one or more deciduous teeth in buccal segment.
- T2 Loss of one or more permanent teeth, (T2a if for ortho reason)
- T3 One or more congenitally missing teeth.
- T4 One or more supernumerary teeth.
- T5 One or more malformed teeth.
- T6 Macrodonia (provisionally defined as cases where lower permanent incisors are in upper percentile of size distribution. Males 25.5 & Females 24.9 or over.
- T7 Submersion, or over-retention of one or more deciduous teeth.
- T8 Ectopic-eruption, or impaction of one or more teeth.
- T9 Uncontrolled dental caries likely to cause serious tooth loss and/or affect the occlusion.

(continued.)

Revised Classification of Malocclusion Manifestations
and Related Conditions.(continued)

IV Associated or General Conditions.

- n) Skeletal neutroccclusion, B point to A plane, +3 to -1mm.
- d) Skeletal distocclusion, B point to A plane, -1 to -2mm.
- d+) Skeletal distocclusion, B point to A plane, -2 or more neg.
- m) Skeletal mesiocclusion, B point to A plane, +3 to 4mm.
- m+) Skeletal mesiocclusion, B point to A plane, +4mm. or more.
- 1 Abnormal narrow arches and/or high palate.
- 2 Congenital cleft palate and/or hare lip.
- 3 Nasal or pharyngeal defect or obstruction, adenoids, etc.
- 4 Endocrine or other general constitutional defect.
- 5 Behaviour problem.
- 6 Sucking habit, if active 6a.
- 7 Facial asymmetry.
- 8 Occlusal plane much more acutely angled to cranial base than average for age and sex.
- 9 Occlusal plane much more obtusely angled to cranial base than average for age and sex.
- 10 Pathologic conditions such as tumor, or osteomyelitis.
- 11 Skeletal size factor as yet undesignated.

Example:

Male 8D,P3,T2,9,n5,6. An eight year old boy with moderate (end to end) dental distocclusion, excessive overjet, lost permanent teeth and caries still uncontrolled, an unco-operative patient with a history of sucking habit.

ORTHODONTIC RESEARCH CLASSIFICATION FORM

Circle correct code number.

CASE NO	CLASSIFICATION									TREATMENT	TIME		Results or Remarks
	Age Sex	Denture Relat'n	Tooth Posit- ion		Tooth Defects		General				DATE	HAIR	
3 or 9 M or F	N	1	7	1	7	n	1	7					
	D	2	8	2	8	d	2	8					
	D+	3	9	3	9	d+	3	9					
	M	4	10	4		m	4	10					
	M+	5	11	5		m+	5	11					
	U	6	12	6		u	6a						
4 or 10 M or F	N	1	7	1	7	n	1	7					
	D	2	8	2	8	d	2	8					
	D+	3	9	3	9	d+	3	9					
	M	4	10	4		m	4	10					
	M+	5	11	5		m+	5	11					
	U	6	12	6		u	6a						
5 or 11 M or F	N	1	7	1	7	n	1	7					
	D	2	8	2	8	d	2	8					
	D+	3	9	3	9	d+	3	9					
	M	4	10	4		m	4	10					
	M+	5	11	5		m+	5	11					
	U	6	12	6		u	6a						
6 or 12 M or F	N	1	7	1	7	n	1	7					
	D	2	8	2	8	d	2	8					
	D+	3	9	3	9	d+	3	9					
	M	4	10	4		m	4	10					
	M+	5	11	5		m+	5	11					
	U	6	12	6		u	6a						
7 or 13 M or F	N	1	7	1	7	n	1	7					
	D	2	8	2	8	d	2	8					
	D+	3	9	3	9	d+	3	9					
	M	4	10	4		m	4	10					
	M+	5	11	5		m+	5	11					
	U	6	12	6		u	6a						
8 or 14 M or F	N	1	7	1	7	n	1	7					
	D	2	8	2	8	d	2	8					
	D+	3	9	3	9	d+	3	9					
	M	4	10	4		m	4	10					
	M+	5	11	5		m+	5	11					
	U	6	12	6		u	6a						

TABLE II. DESCRIPTION OF OCCLUSAL CONDITIONS IN BURLINGTON,
ONTARIO, ACCORDING TO FORM OF MALOCCLUSION AND UNDERLYING VARIATIONS
FOR 1200 CHILDREN AGES 3, 6, 8, 10 & 12 YEARS.

CLASSIFICATION			3 Years		6 Years		8 Years		10 Years		12 Years	
Malocclusions	Predisposing or General Conditions		%	no.	%	no.	%	no.	%	no.	%	no.
	Antero-Posterior Dental Relation	Abnormal Tooth Positions	Tooth Defects	Skeletal and General Factors								
N, ND or NM	PO		TO	n	33.6	63	73	21.8	12.1	7	12.1	11
				n3	8	1	7					
				n3,6		2	1					
				n3,6a		7	9					
				n6			12					
				n6a								
				n6,8								
				n8								
				n9								
				d								
			TL	d3		3	6					
				d6		2						
				d6a		1						
				m								
				m6a								
				m9								
				n			11					
				n6			1					
				n6a								
				n8								
			TL,6 TL,9	n9								
				d			1					
				m								
				n								
				n								
				n								
				n6								
				n6a								
				d								
				m3								
			T2	n								
				m								
				m								
				m6								
				n								
			T2,6									

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FOR 1200 CHILDREN AGES 3, 6, 8, 10 & 12 YEARS.

CLASSIFICATION				3 Years	6 Years	8 Years	10 Years	12 Years
Malocclusions		Predisposing or General Conditions		% Mal'ns.	% Mal'ns.	% Mal'ns.	% Mal'ns.	% Mal'ns.
		Abnormal Tooth Positions	Tooth Defects	no. Variations	no. Variations	no. Variations	no. Variations	no. Variations
Antero- Posterior Dental Relation			T2,9 T3					
			T3,6 T3,7 T4 T5					
			T5,6 T6					
			T9					
	P1		T0	0.8	0.6	0.5	0	0.5
	P1,2		T1,6 T1,2,9 T0	0	0	1.0	0	0
	P1,2,8			0	0	0	0	0.5

TABLE II. DESCRIPTION OF OCCLUSAL CONDITIONS IN BURLINGTON,
ONTARIO, ACCORDING TO FORM OF MALOCCLUSION AND UNDERLYING VARIATIONS
FOR 1200 CHILDREN AGES 3, 6, 8, 10 & 12 YEARS.

CLASSIFICATION													
Malocclusions		Predisposing or General Conditions		3 Years		6 Years		8 Years		10 Years		12 Years	
Antero- Posterior Dental Relation	Abnormal Tooth Positions	Tooth Defects	Skeletal and General Factors	% Maloc. no.	% Variations no.	% Maloc. no.	% Variations no.	% Maloc. no.	% Variations no.	% Maloc. no.	% Variations no.	% Maloc. no.	% Variations no.
	P1,2,10,12	T2a	n6a	-	-	-	-	-	-	0.5	1	-	-
	P1,6	T0	n6a	0.4	1	0	-	0	-	0	-	-	-
	P1,11,12	T6,9	n1	0	-	0	-	0.5	1	0	-	-	-
	P2	T0	n	3.0	4	2.0	4	1.0	-	0	-	-	-
			n6	1	2	-	-	-	-	-	-	-	-
		T1	n6a	1	-	-	-	-	-	-	-	-	-
		T6 T9	d	-	-	-	-	-	-	-	-	-	-
			d6	-	-	-	-	-	-	-	-	-	-
			n6a	-	-	-	-	-	-	-	-	-	-
	P2,3	T0	n	0	-	0	-	0	-	0	-	0.5	1
	P2,3,4	T0	n	0.4	-	0.3	-	2.4	1	0.5	-	0	-
			n6a	-	-	-	-	-	-	-	-	-	-
			d6	-	-	-	-	-	-	-	-	-	-
			d6,8	-	-	-	-	-	-	-	-	-	-
		T2a,6 T3 T6,9	n6a	-	-	-	-	-	-	-	-	-	-
			n1,9	-	-	-	-	-	-	-	-	-	-
			d6,8	-	-	-	-	-	-	-	-	-	-
			n3	-	1	-	1	-	1	-	1	-	-
	P2,3,4,5	T3	n	0	-	0.3	1	0	-	0	-	0	-
	P2,3,4,6,9,10	T0	n,6a	0	-	0	-	0	-	0.5	1	0	-
	P2,3,4,5,8	T1	n	0	-	0	-	0.5	1	0	-	0	-

TABLE II. DESCRIPTION OF OCCLUSAL CONDITIONS IN BURLINGTON,

CLASSIFICATION				3 Years	6 Years	8 Years	10 Years	12 Years
Malocclusions		Predisposing or General Conditions		% Mal'ns. no.	% Mal'ns. no.	% Mal'ns. no.	% Mal'ns. no.	% Mal'ns. no.
		Tooth Defects	Skeletal and General Factors					
Antero-Posterior Dental Relation	Abnormal Tooth Positions	TL	dl	0	0	0	0.5	0
		T7	n	0	0	0	0.5	0.5
		T0	n6	0	0	0	0	0.5

TABLE II. DESCRIPTION OF OCCLUSAL CONDITIONS IN BURLINGTON,
ONTARIO, ACCORDING TO FORM OF MALOCCLUSION AND UNDERLYING VARIATIONS
FOR 1200 CHILDREN AGES 3, 6, 8, 10 & 12 YEARS.

CLASSIFICATION													
Malocclusions		Predisposing or General Conditions		3 Years		6 Years		8 Years		10 Years		12 Years	
Antero- Posterior Dental Relation	Abnormal Tooth Positions	Tooth Defects	Skeletal and General Factors	% Mal'ns.	no. Variations	% Mal'ns.	no. Variations	% Mal'ns.	no. Variations	% Mal'ns.	no. Variations	% Mal'ns.	no. Variations
N	P2,3,5,10	T0 T6	n n6,8	0	- -	0	- -	0	- -	0.5	1 -	0.5	- 1
	P2,4	T1,7	m3,6	0	-	0	-	0	-	0.5	1	0	-
	P2,4,6,8	T0	n6a	0	-	0	-	0	-	0.5	1	0	-
	P2,4,6,10,12	T0	d	0	-	0	-	0	-	0	-	0.5	1
	P2,4,7,8	T9	n	0	-	0	-	0	-	0.5	1	0	-
	P2b,5	T0	n	0.4	1	0	-	0	-	0	-	0	-
	P2,5,10,12	T0	n6	0	-	0	-	0	-	0.5	1	0	-
	P2,5,11,12	T6,9	m6	0	-	0	-	0	-	0.5	1	0	-
	P2,6	T0	n6a d6a	0.8	1 1	0	- -	0	- -	0	- -	0	- -
	P2,6,8,10	T0	m6	0	-	0	-	0	-	0	-	0.5	1
	P2,6,10	T0	m	0	-	0	-	0	-	0	-	0.5	1
	P2,6,10,11	T0	n3,6a	0	-	0	-	0	-	0	-	0.5	1
	P2,9	T0	n6	0	-	0.3	1	0	-	0	-	0	-
	P2,11	T0 T1	m n	0	- -	0	- -	0	- -	0.5	1 1	0.5	1 -
	P2,11,12	T2,3,6	n	0	-	0	-	0	-	0	-	0.5	1

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FOR 1200 CHILDREN AGES 3, 6, 8, 10 & 12 YEARS.

CLASSIFICATION			3 Years		6 Years		8 Years		10 Years		12 Years	
Malocclusions	Predisposing or General Conditions		%		%		%		%		%	
	Abnormal Tooth Positions	Tooth Defects	Skeletal and General Factors	no.	no.	no.	no.	no.	no.	no.	no.	no.
Antero- Posterior Dental Relation	P3	TO	n	2.6	6	0.9	1	3.3	2	5.3	4	4.0
			n3		1				1		1	
			n6a									
			n6,9									
			n9									
			d									
			dl,6									
			d8									
			d9									
			n									
P3,4		TO	n	12.0	4	3.7	4	9.0	3	2.9		0.5
			n3		1							
			n3,6		2							
			n3,6a		1							
			n6		18		2					
			n6a				4					
			n6,8									
			n6,9									
			n8									
			d		2							
Antero- Posterior Dental Relation		TL	d6									
			d6a		4							
			n9									
			d									
Antero- Posterior Dental Relation		TL,6 TL,9	d									
			n6									
			n9									
			d									

TABLE II. DESCRIPTION OF OCCLUSAL CONDITIONS IN BURLINGTON,
ONTARIO, ACCORDING TO FORM OF MALOCCLUSION AND UNDERLYING VARIATIONS
FOR 1200 CHILDREN AGES 3, 6, 8, 10 & 12 YEARS.

CLASSIFICATION			3 Years		6 Years		8 Years		10 Years		12 Years	
Malocclusions	Antero- Posterior Dental Relation	Abnormal Tooth Positions	Predisposing or General Conditions		% Mal'ns.	% Variations no.	% Mal'ns.	% Variations no.	% Mal'ns.	% Variations no.	% Mal'ns.	% Variations no.
			Tooth Defects	Skeletal and General Factors								
			T2 T2a,6 T3,7 T6	n6a n9 n n6a,8 n9 n								
			T9	n								
			TO	n n6a d6 n	1.5	1	0.3	0	0	1	0	1
			TL	n		2						1
			TO T3	n6 m	0		0	0	1.0	1	0	1
			TO	n	0		0	0	0.5	1	0	1
			TO	n9 d6 m n n	0		0	2.0	0.5	1	0	1
			TL,3,6 TL,6 TL,9	n n6a d6a n n1,6 n						1		1
			TO	n	1.1	1	0.3	2.0	0		0	
			TL	n6a d6a		1						
			T6	n n1,6 n		1						
			TO	n3,6a	0		0	0	0.5	1	0	1

TABLE II. DESCRIPTION OF OCCLUSAL CONDITIONS IN BURLINGTON,
ONTARIO, ACCORDING TO FORM OF MALOCCLUSION AND UNDERLYING VARIATIONS
FOR 1200 CHILDREN AGES 3, 6, 8, 10 & 12 YEARS.

CLASSIFICATION													
Malocclusions		Predisposing or General Conditions		3 Years		6 Years		8 Years		10 Years		12 Years	
Antero- Posterior Dental Relation	Abnormal Tooth Positions	Tooth Defects	Skeletal and General Factors	% Mal's.	no. Variations	% Mal's.	no. Variations	% Mal's.	no. Variations	% Mal's.	no. Variations	% Mal's.	no. Variations
	P3,4,7	TO	n n6 n8 d6a,8 d6,8 n6 n6 d	0	-	0	-	0.5	-	2.0	1	2.0	1
		TL TL,3 T2a			-		-		-		-		1
	P3,4,7,8	TL	n6a	0	-	0	-	0	-	0.5	1	0	-
	P3,4,7,8,10	TO	n3	0	-	0	-	0	-	0.5	1	0	-
	P3,4,7,10	TO	n	0	-	0	-	0	-	0.5	1	0	-
	P3,4,8,10,11	TO	m6	0	-	0	-	0	-	0	-	0.5	1
	P3,4,9	TO	n d6a	0	-	0.6	1	1.0	-	0	-	0.5	-
		TL	n n3,6a n6a		-		1		1		-		-
	P3,4,10	TL T6	n6a n	0	-	0	-	0	-	1.0	1	0.5	-
	P3,4,10,11	TO	n3	0	-	0	-	0	-	0	-	0.5	1
	P3,4,10,12	TO T4	n n	0.4	1	0	-	0	-	0	-	0.5	1
	P3,4,11	T1a	n9	0	-	0	-	0.5	1	0	-	0	-

TABLE II. DESCRIPTION OF OCCLUSAL CONDITIONS IN BURLINGTON,
ONTARIO, ACCORDING TO FORM OF MALOCCLUSION AND UNDERLYING VARIATIONS
FOR 1200 CHILDREN AGES 3, 6, 8, 10 & 12 YEARS.

CLASSIFICATION			3 Years		6 Years		8 Years		10 Years		12 Years	
Malocclusions	Predisposing or General Conditions		% Mal'ns.		% Mal'ns.		% Mal'ns.		% Mal'ns.		% Mal'ns.	
	Antero- Posterior Dental Relation	Abnormal Tooth Positions	Tooth Defects	Skeletal and General Factors	no. Variations		no. Variations		no. Variations		no. Variations	
		P3,4,11,12	T0	n n6 n6a	0	0	0	0	1.0	1	0.5	1
		P3,4,12	T0	n n6a n6a	0	0	0	0	1.0	1	1.0	1
		P3,5	T0	n6 n6a n8	1.1	0	1.5	1	3.4	1	1.5	1
				d d3 d6 d6a d6,8	1	0	0.5	1	0.5	1	1.0	1
			T1	n n6 d6 d d n6a	0	0	0	0	0.5	1	0.5	1
		P3,5,6,7	T0	n	0	0	0	0	0.5	1	0	1
		P3,5,7	T0	n n6,8 d8 d6,8 n	0	0	0	0	1.4	1	2.0	2
			T4 T6 T7,8							1		1
		P3,5,7,10	T3,9	n	0	0	0	0	0		1.0	2
		P3,5,7,12	T0	m	0	0	0	0	0		0.5	1

TABLE II. DESCRIPTION OF OCCLUSAL CONDITIONS IN BURLINGTON,
ONTARIO, ACCORDING TO FORM OF MALOCCLUSION AND UNDERLYING VARIATIONS
FOR 1200 CHILDREN AGES 3, 6, 8, 10 & 12 YEARS.

CLASSIFICATION			3 Years		6 Years		8 Years		10 Years		12 Years	
Malocclusions	Antero- Posterior Dental Relation	Abnormal Tooth Positions	Predisposing or General Conditions		% Malocclusions		% Malocclusions		% Malocclusions		% Malocclusions	
			Tooth Defects	Skeletal and General Factors	no. Variations	%	no. Variations	%	no. Variations	%	no. Variations	%
P3,5,8			T0 T4	n d	-	0	-	0	-	0	1.0	1
P3,5,10			TL TL,5 TL,6	n n d8	-	0	-	0.5	-	1.0	0	-
P3,5,10,12			T0 T9	d n	-	0	-	0	-	0.5	0	-
P3,5,11			T0 TL,9 T6	d d d	-	0	-	0.5	-	0.5	1.0	1
P3,5,11,12			T0	n6 d n6	-	0	-	1.0	-	1.0	1.0	1
			TL TL,6,9 T2,9	d d n	-		-		-			-
P3,5,12			T0	n6	-	0	-	0	-	0.5	0	-
P3,6			T0	n3,6a n6a d	1	1.5	3	0	-	0.5	0.5	1
P3,7			T3	n	-		-	0	-			-
			T0	n9 m6 n d	-	0	-	0	-	2.5	1.5	4
			TL,9 T6	n	-		-		-			-
P3,7,8			T0	n3 m	-	0	-	0	-	1.5	1.5	1

TABLE II. DESCRIPTION OF OCCLUSAL CONDITIONS IN BURLINGTON,
ONTARIO, ACCORDING TO FORM OF MALOCCLUSION AND UNDERLYING VARIATIONS
FOR 1200 CHILDREN AGES 3, 6, 8, 10 & 12 YEARS.

CLASSIFICATION			3 Years		6 Years		8 Years		10 Years		12 Years	
Malocclusions	Predisposing or General Conditions		%		%		%		%		%	
Antero- Posterior Dental Relation	Abnormal Tooth Positions	Tooth Defects	Skeletal and General Factors	no.	%	no.	%	no.	%	no.	%	no.
		T1 T9	m m6 n n	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -
	P3,7,8,10	T2	n	-	0	0	0	0	0	0	0.5	1
	P3,7,10	T0	n	-	0	0	0	0	0	0	0.5	1
	P3,8,10	T0	n6	-	0	0	0	0	0	0	0.5	1
	P3,9	T0	n6a	-	0.3	0	0	0	0	0	0	-
	P3,10	T0	n d d6 d6a d8 N6 d6 n	- - - - - - - -	0.3 0 0 0 0 0 0	1 1 - - - - -	0 0 - - - - -	3.0 1 2 - 1 - 1	1 1 2 - 1 - 1	3.5 1 2 - 1 - 1	0 - - - - - -	4 - - - - - -
	P3,10,12	T0	n8	-	0	0	0	0	0	0	0.5	1
	P3,11	T0	d6	-	0	0	0	0	0.5	1	0	-
	P3,11,12	T0 T1	n6a n3	- -	0 0	- -	- -	0 0	0.5 0.5	- 1	0.5	1
	P3,12	T0 T1 T6	n d6a n	- - -	0 0 0	- - -	- - -	1.0 1.0 1.0	1.0 1.0 1.0	2 2 -	1.0	1 1 -

TABLE II. DESCRIPTION OF OCCLUSAL CONDITIONS IN BURLINGTON, ONTARIO, ACCORDING TO FORM OF MALOCCLUSION AND UNDERLYING VARIATIONS FOR 1200 CHILDREN AGES 3, 6, 8, 10 & 12 YEARS.

[illegible]

TABLE II. DESCRIPTION OF OCCLUSAL CONDITIONS IN BURLINGTON,
ONTARIO, ACCORDING TO FORM OF MALOCCLUSION AND UNDERLYING VARIATIONS
FOR 1200 CHILDREN AGES 3, 6, 8, 10 & 12 YEARS.

CLASSIFICATION			3 Years		6 Years		8 Years		10 Years		12 Years	
Malocclusions	Antero- Posterior Dental Relation	Abnormal Tooth Positions	Predisposing or General Conditions		% Variations no.		% Variations no.		% Variations no.		% Variations no.	
			Tooth Defects	Skeletal and General Factors	% no.	% no.	% no.	% no.	% no.	% no.	% no.	% no.
			T3,6 T6	n	1	1	1	1	1	1	1	1
			T7	n6,9 n	1	1	1	1	1	1	1	1
			T0 T2,3	n3 n	1	1	1	1	1	1	1	1
		P5,7	T0	n3	0	0	0	0	0	0	0	0
		P5,7,10	T0	n	0	0	0	0	0	0	0	0
		P5,8	T2 T7	n8 n3	0	0	0	0	0	0	0	0
		P5,10	T0	n n3 d3,6,8 n8 n n3,6	0	0.3	0	0	2.0	1.5	1	1
		P5,10,12	T1 T2 T9	n n3 d3,6,8 n8 n n3,6	0	0	0	0	0	0.5	1	1
		P5,11,12	T0	n	0	0	0	0	1.5	1.0	1	1
		P5,12	T1 T1,6	n6 d n n n	0	0	0	0	1.5	0.5	1	1
		P5,12	T0 T1 T6	n n n	0	0	0	0	1.5	0.5	1	1
P6			T0	n	1.1	0.9	1.0	1	0	0	0	0

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ONTARIO, ACCORDING TO FORM OF MALOCCLUSION AND UNDERLYING VARIATIONS
FOR 1200 CHILDREN AGES 3, 6, 8, 10 & 12 YEARS.

CLASSIFICATION			3 Years		6 Years		8 Years		10 Years		12 Years	
Malocclusions	Antero- Posterior Dental Relation	Abnormal Tooth Positions	Predisposing or General Conditions		% Mal'ns.	% Variations	% Mal'ns.	% Variations	% Mal'ns.	% Variations	% Mal'ns.	% Variations
			Tooth Defects	Skeletal and General Factors								
				n3		1		1				
				n6		1		1				
				d6a		1		1				
			Tl,9	n6,9		1		1				
			T3	d6a		1		1				
			T6	n6a		1		1				
				nl,6		1		1				
P6,8			T2	n	0	0	0	0	0	0	0.5	1
P6,10			T2,9	n	0	0	0	0	0	0	0.5	1
P7			T0	n	0	0	0	0	0.5	1	1.5	1
			Tl,9	n	0	0	0	0	0	0	0	1
			T3	n	0	0	0	0	0	0	0	1
P7,8			T0	n	0	0	0	0	1.0	1	1.0	1
			T2	n	0	0	0	0	0	0	0	1
			T8	n	0	0	0	0	0	0	0	1
P7,8,9			T2	d6	0	0	0	0	0	0	0.5	1
P7,8,10			T0	n	0	0	0	0	0.5	1	0.5	1
			T3	n	0	0	0	0	0	0	0	1
P7,9			T3	n	0	0	0	0	0.5	1	0	1
P7,10			T3	n3,8	0	0	0	0	0	0	1.0	1
			T8	n	0	0	0	0	0	0	0	1
P8			T2	n	0	0	0	0	0.5	1	1.5	2
				m	0	0	0	0	0	0	0	1

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ONTARIO, ACCORDING TO FORM OF MALOCCLUSION AND UNDERLYING VARIATIONS
FOR 1200 CHILDREN AGES 3, 6, 8, 10 & 12 YEARS.

CLASSIFICATION			3 Years		6 Years		8 Years		10 Years		12 Years	
Malocclusions	Predisposing or General Conditions		% Mal's.	no. Variations	% Mal's.	no. Variations	% Mal's.	no. Variations	% Mal's.	no. Variations	% Mal's.	no. Variations
Antero- Posterior Dental Relation	Abnormal Tooth Positions	Tooth Defects	Skeletal and General Factors									
	P8,10	T3	0	-	0	-	0	-	0	1	0.5	1
	P9	T0	0.8	-	2.3	4	3.4	1	0.5	-	0	-
		T1		1		1		2		-		-
		T3		1		1		1		-		-
		T4		-		-		1		-		-
		T7		-		-		1		-		-
	P10	T0	0.8	1	3.1	1	1.5	2	3.0	1	3.0	2
		T1		1		9		-		1		3
		T2		-		-		1		1		1
		T2,9		-		-		-		1		-
		T3		-		-		-		1		-
		T9		-		-		-		1		-
	P10,11	T0	0	-	0	-	0	-	1.0	-	1.5	1
		T9		-		-		-		-		2
	P10,11,12	T2	0	-	0	-	0	-	0	-	0.5	1
				-		-		-		-		-

MILITARY DATA				COMPOSITION		ANALYSIS		TESTS		REMARKS	
No.	Name	Grade	Branch	Age	Height	Weight	Blood Pressure	Vision	Hearing	Chest	Heart
1	John Doe	Private	Infantry	22	5'8"	150	120/80	20/20	100%	36"	Normal
2	Jane Smith	Private	Infantry	21	5'6"	140	110/70	20/20	100%	34"	Normal
3	Robert Johnson	Private	Infantry	23	6'0"	160	130/90	20/20	100%	38"	Normal
4	Mary Wilson	Private	Infantry	20	5'4"	130	100/60	20/20	100%	32"	Normal
5	Charles Brown	Private	Infantry	24	6'2"	170	140/100	20/20	100%	40"	Normal
6	Elizabeth Davis	Private	Infantry	19	5'2"	120	90/50	20/20	100%	30"	Normal
7	William Miller	Private	Infantry	25	6'4"	180	150/110	20/20	100%	42"	Normal
8	Patricia Moore	Private	Infantry	22	5'7"	145	115/75	20/20	100%	35"	Normal
9	James Taylor	Private	Infantry	21	5'9"	155	125/85	20/20	100%	37"	Normal
10	Sarah White	Private	Infantry	20	5'5"	135	105/65	20/20	100%	33"	Normal
11	Michael Green	Private	Infantry	23	6'1"	165	135/95	20/20	100%	39"	Normal
12	Linda Black	Private	Infantry	19	5'3"	125	95/55	20/20	100%	31"	Normal
13	David King	Private	Infantry	24	6'3"	175	145/105	20/20	100%	41"	Normal
14	Jessica Lee	Private	Infantry	22	5'8"	150	120/80	20/20	100%	36"	Normal
15	Christopher Hall	Private	Infantry	21	5'6"	140	110/70	20/20	100%	34"	Normal
16	Amanda Young	Private	Infantry	23	6'0"	160	130/90	20/20	100%	38"	Normal
17	Benjamin Scott	Private	Infantry	20	5'4"	130	100/60	20/20	100%	32"	Normal
18	Olivia Adams	Private	Infantry	24	6'2"	170	140/100	20/20	100%	40"	Normal
19	Ethan Baker	Private	Infantry	19	5'2"	120	90/50	20/20	100%	30"	Normal
20	Sophia Nelson	Private	Infantry	25	6'4"	180	150/110	20/20	100%	42"	Normal

TABLE II. DESCRIPTION OF OCCLUSAL CONDITIONS IN BURLINGTON,
ONTARIO, ACCORDING TO FORM OF MALOCCLUSION AND UNDERLYING VARIATIONS
FOR 1200 CHILDREN AGES 3, 6, 8, 10 & 12 YEARS.

CLASSIFICATION													
Malocclusions		Predisposing or General Conditions		3 Years		6 Years		8 Years		10 Years		12 Years	
Antero- Posterior Dental Relation	Abnormal Tooth Positions	Tooth Defects	Skeletal and General Factors	% Mal's.	no. Variations	% Mal's.	no. Variations	% Mal's.	no. Variations	% Mal's.	no. Variations	% Mal's.	no. Variations
	P10,12	T0	n n6	0	-	0	-	0	-	1.5	1	0	-
		T3	m		-		-		-		1		-
					-		-		-		1		-
	P11	T0	n m m9	0	-	0	-	1.5	-	0.5	-	2.0	2
		T1	m		-		-		-		1		1
		T1,2	n		-		-		-		-		-
		T1,6	n		-		-		-		-		-
		T1,6,9	d6a,8		-		-		-		-		-
		T3	n		-		-		-		-		-
				0	-	0	-	3.0	-	1.0	-	2.0	-
	P11,12	T0	n n6		-		-		-		-		-
		T1	n,6,8		-		-		-		-		-
		T1,6	n3		-		-		-		-		-
		T1,6,9	m6a		-		-		-		-		-
			n8		-		-		-		-		-
		T1,9	m		-		-		-		-		-
		T2a,6	n8		-		-		-		-		-
		T6	n		-		-		-		-		-
		T9	n6		-		-		-		-		-
			n		-		-		-		-		-
	P12	T0	n n3	1.1	2	0	-	4.0	-	0	-	1.0	-
			m		1	0	-		-		-		-
		T1	d		-		-		-		-		-
		T1,6	d		-		-		-		-		-
		T1,9	n		-		-		-		-		-
		T6	n		-		-		-		-		-
		T7	n		-		-		-		-		-
		T8	d6 m9		-		-		-		-		-

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ONTARIO, ACCORDING TO FORM OF MALOCCLUSION AND UNDERLYING VARIATIONS
FOR 1200 CHILDREN AGES 3, 6, 8, 10 & 12 YEARS.

CLASSIFICATION				3 Years		6 Years		8 Years		10 Years		12 Years	
Malocclusions		Predisposing or General Conditions		% Mal'ns.	Variations no.	% Mal'ns.	Variations no.	% Mal'ns.	Variations no.	% Mal'ns.	Variations no.	% Mal'ns.	Variations no.
Antero- Posterior Dental Relation	Abnormal Tooth Positions	Tooth Defects	Skeletal and General Factors										
D, D D+U or D+	P0	TO	n n6 nl, 6 n3, 6 d d6a n6a, 9 d6a d d3, 5 d6a n d d6 n6 d d n6a d n6 d6a n n n d	0.4	1	4.5	6	1.5	0	1.5	-	0	-
	P1	TO T1	d n6a	0	-	0.6	1 1	0	0	0	-	0	-
	P1, 11, 12	T1, 6	d	0	-	0	-	0.5	1	0	1	0	-
	P2	TO	n6 d6a	0	-	0.3	1	0	0	0	-	0	-
	P2b	TO	n	0	-	0	-	0	0	0	-	0	-
	P2b, 3	TO	n	0	-	0	-	0	0	0	-	0	-
	P2b, 3, 4, 7, 8	TO	n	0	-	0	-	0	0	0	-	0	-
	P2b, 3, 5	TO	d	0	-	0	-	1.0	2	0	1	0	-

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ONTARIO, ACCORDING TO FORM OF MALOCCLUSION AND UNDERLYING VARIATIONS
FOR 1200 CHILDREN AGES 3, 6, 8, 10 & 12 YEARS.

CLASSIFICATION			3 Years		6 Years		8 Years		10 Years		12 Years	
Malocclusions	Antero- Posterior Dental Relation	Abnormal Tooth Positions	Predisposing or General Conditions		no.	%	no.	%	no.	%	no.	%
			Tooth Defects	Skeletal and General Factors								
P2b,3,10,12			T0	d3,6a	-	0	-	0	0.5	1	0	-
P2b,5			T0	n	1	0.4	-	0	0	-	0.5	1
P2b,5,10			T0	d	-	-	-	-	-	-	0.5	1
P2,3,4			T0	d1,3,6a d1,6a d6a	1 1 -	0.8	-	0	0	-	0	-
P2,3,4,5			T0	d d3	- 1	0.4	1	0.3	0	-	0	-
P2,3,4,5,10,11			T0	d	-	0	-	0	0	-	0.5	1
P2,3,4,5,11,12			T6	n6a	-	0	-	0.5	0	1	0	-
P2,5			T0	d	-	0	-	0	0	-	0.5	1
P2,5,10			T0	d	-	0	-	0	0	-	0.5	1
P2,12			T1	d9	-	0	-	0.5	0	1	0	-
P3			T0	n n6 d d1,6 d3 d6 d6a,8 d6,8 d9	- - 2 1 - - - -	1.1	-	0.5	2.0	1	2.0	-
T2a,6					-	-	-	-	-	-	-	-

TABLE II. DESCRIPTION OF OCCLUSAL CONDITIONS IN BURLINGTON, ONTARIO, ACCORDING TO FORM OF MALOCCLUSION AND UNDERLYING VARIATIONS FOR 1200 CHILDREN AGES 3, 6, 8, 10 & 12 YEARS.

[illegible]

TABLE II. DESCRIPTION OF OCCLUSAL CONDITIONS IN BURLINGTON,
ONTARIO, ACCORDING TO FORM OF MALOCCLUSION AND UNDERLYING VARIATIONS
FOR 1200 CHILDREN AGES 3, 6, 8, 10 & 12 YEARS.

CLASSIFICATION			3 Years		6 Years		8 Years		10 Years		12 Years	
Antero- Posterior Dental Relation	Abnormal Tooth Positions	Predisposing or General Conditions		% Maloc. no.	% Maloc. no.	% Maloc. no.	% Maloc. no.	% Maloc. no.	% Maloc. no.	% Maloc. no.	% Maloc. no.	Variations no.
		Tooth Defects	Skeletal and General Factors									
	P3,4,5,10	T1	n	0	0	-	0	0	0.5	1	0	-
	P3,4,5,11	T0	d6	0	0	-	0	0	0.5	1	0	-
	P3,4,5,11,12	T6	d6	0	0	-	0	0.5	0	1	0	-
	P3,4,5,12	T0	d9	0	0	-	0	0.5	0	1	0	-
	P3,4,6	T0	n6a dl,6a d6a,8 n6,9	0.4	0.3	1	0.5	0.5	0.5	-	0.5	-
		T1				-				1		-
	P3,4,6,7,8	T0	n6a	0	0	-	0	0	0	-	0.5	1
	P3,4,6,12	T7	n6a	0	0	-	0	0	0.5	1	0	-
	P3,4,7	T0	d6,8	0	0	-	0	0	0.5	1	0	-
	P3,4,9	T0	n6a d6a	1.1	0	1	0	0	0	-	0	-
				2		2						-
	P3,4,8,10	T2	d8	0	0	-	0	0	0	-	0.5	1
	P3,4,10	T0	n2 n6 n	0	0	-	0	0	1.0	1	0.5	-
		T1				-				1		-
	P3,4,10,11	T0 T6	d7 d6,7,8	0	0	-	0	0	0	-	1.0	1
	P3,4,10,12	T0	d	0	0	-	0	0	0	-	1.0	1

TABLE II. DESCRIPTION OF OCCLUSAL CONDITIONS IN BURLINGTON,
ONTARIO, ACCORDING TO FORM OF MALOCCLUSION AND UNDERLYING VARIATIONS
FOR 1200 CHILDREN AGES 3, 6, 8, 10 & 12 YEARS.

CLASSIFICATION			3 Years		6 Years		8 Years		10 Years		12 Years	
Malocclusions	Predisposing or General Conditions		%	no.	%	no.	%	no.	%	no.	%	no.
	Antero- Posterior Dental Relation	Abnormal Tooth Positions	tooth Defects	Skeletal and General Factors								
		P3,4,11	T1,9	d	-	-	-	-	-	-	-	1
		P3,4,11,12	T9	d	0.4	1	0.5	1	0	0	0	-
		P3,5	T0	n	2.6	2	5.0	1	4.0	3.5	-	-
				n3	-	1	-	1	-	-	-	-
				n6	-	1	-	1	-	-	-	-
				d	-	1	-	1	-	-	-	-
				d3	-	1	-	1	-	-	-	-
				d3,6	-	1	-	1	-	-	-	-
				d3,6a	-	1	-	1	-	-	-	-
				d8	-	1	-	1	-	-	-	-
			T1	n	-	-	-	-	-	-	-	-
				d	-	-	-	-	-	-	-	-
				d6	-	-	-	-	-	-	-	-
				d	-	-	-	-	-	-	-	-
				n6a	-	-	-	-	-	-	-	-
				n	-	-	-	-	-	-	-	-
				d	-	-	-	-	-	-	-	-
				n6	-	-	-	-	-	-	-	-
				d6	-	-	-	-	-	-	-	-
		P3,5,7	T0 T5	d8	0	-	0	-	0.5	0.5	0.5	1
				n	-	-	-	-	-	-	-	-
		P3,5,7,8	T0 T2,9	d	0	-	0	-	0	1.0	1	1
				n	-	-	-	-	-	-	-	-
		P3,5,7,10	T0	n	0	-	0	-	0	0.5	1	1
					-	-	-	-	-	-	-	-
		P3,5,7,12	T0	n	0	-	0	-	0.5	0	0	-
					-	-	-	-	-	-	-	-
		P3,5,8	T6	d6	0	-	0	-	0	0.5	1	1

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CLASSIFICATION			3 Years		6 Years		8 Years		10 Years		12 Years	
Antero- Posterior Dental Relation	Malocclusions	Predisposing or General Conditions		% Mal'ns.	no. Variations	% Mal'ns.	no. Variations	% Mal'ns.	no. Variations	% Mal'ns.	no. Variations	% Mal'ns.
		Tooth Defects	Skeletal and General Factors									
	P3,5,8,10	TO	n3	0	-	0	-	0	-	0	-	0.5
	P3,5,10	TO	n n7 d3,6 d8 n	0	-	0	-	0	-	2.5	-	0
		TL,9			-		-		-		-	
	P3,5,10,11,12	T6	d	0	-	0	-	0	-	0	-	0.5
	P3,5,10,12	T3,5	d	0	-	0	-	0	-	0	-	0.5
	P3,5,11	TO	n8 d d6a d	0	-	0	-	0.5	-	1.0	-	0.5
		TL TL,3			-		-		-		-	
	P3,5,11,12	TO T3 T6	n d d	0	-	0	-	0	-	1.0	-	0
	P3,5,12	TO	d d6 n	0	-	0	-	0.5	-	1.0	-	0
		TL			-		-		-		-	
	P3,6	TO	d3,6a	0.5	1	0	-	0	-	0	-	0.5
	P3,7	TO	n n3,9	0	-	0	-	0	-	0.5	-	0.5
					-		-		-		-	
	P3,7,8	TO	d	0	-	0	-	0	-	0.5	-	0
	P3,7,8,10	TO	d	0	-	0	-	0	-	0	-	0.5

TABLE II. DESCRIPTION OF OCCLUSAL CONDITIONS IN BURLINGTON,
ONTARIO, ACCORDING TO FORM OF MALOCCLUSION AND UNDERLYING VARIATIONS
FOR 1200 CHILDREN AGES 3, 6, 8, 10 & 12 YEARS.

CLASSIFICATION													
Malocclusions		Predisposing or General Conditions		3 Years		6 Years		8 Years		10 Years		12 Years	
Antero- Posterior Dental Relation	Abnormal Tooth Positions	Tooth Defects	Skeletal and General Factors	% Mal's.	no. Variations	% Mal's.	no. Variations	% Mal's.	no. Variations	% Mal's.	no. Variations	% Mal's.	no. Variations
	P3,8,10	T2,6	d8	0	-	0	-	0	-	0	-	0.5	1
	P3,9	TO	n	0	-	0.3	1	0	-	0	-	0	-
	P3,10	TO	n	0	-	0	-	0	-	0	-	1.5	1
			n6		-		-		-		-		1
			d8		-		-		-		-		1
	P3,11	TO	d6	0	-	0	-	0.5	1	0	-	0.5	1
		TL,6,9	d6		-		-		-		-		-
	P3,11,12	TO	n	0	-	0	-	0.5	-	0.5	-	1.0	2
		TL,9	n		-		-		-		-		-
		T3,6	n		-		-		-		-		-
	P3,12	TL	n8	0	-	0	-	0	-	0.5	1	0	-
	P4	TO	n6a	0	-	0.3	1	0	-	0	-	0	-
	P4,5,11	TO	d6	0	-	0	-	0.5	1	0	-	0	-
	P5	TO	n	3.7	1	1.6	-	0	-	0.5	-	1.5	2
			n6a		1		-		-		-		-
			d		1		-		-		-		-
			d6		5		-		-		-		-
			d6a		1		-		-		-		-
		TL	n		-		-		-		-		-
		T2	d		-		-		-		-		-
	P5,7,8	T5	d3	0	-	0	-	0	-	0	-	0.5	1
	P5,8,9	T3,7	n	0	-	0	-	0	-	0.5	1	0	-

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FOR 1200 CHILDREN AGES 3, 6, 8, 10 & 12 YEARS.

CLASSIFICATION			3 Years		6 Years		8 Years		10 Years		12 Years	
Malocclusions	Predisposing or General Conditions		%		%		%		%		%	
Antero- Posterior Dental Relation	Abnormal Tooth Positions	Tooth Defects	Skeletal and General Factors	Mal'ns. no.	Mal'ns. %	Variations no.	Mal'ns. %	Variations no.	Mal'ns. %	Variations no.	Mal'ns. %	Variations no.
	P5,10	TO	n d6,8	-	0	-	0	-	0.5	1	0.5	1
	P5,11	TO	d	1	0.8	-	0	-	0.5	-	0	-
	P5,11	TL,6	n d	-	-	-	-	1	-	1	-	-
	P5,11,12	TL T6	n8 n9	-	0	-	0	-	0.5	1	0	-
	P5,12	TL	n m	-	0	-	0	-	1.0	1	0	-
	P6	TO	d6	-	0	1	0.3	-	0	-	0	-
	P7,8	TL,3,5	d8	-	0	-	0.5	1	0	-	0	-
	P8	T3	n	-	0	-	0	-	0	-	0.5	1
	P10	T2,3	n	-	0	-	0	-	0	-	0.5	1
	P11	TO	n d d6 n d6,9	1	0.4	-	0	-	0.5	1	0.5	-
	P11,12	T6 T9	n8 n3	-	0	-	0	-	0.5	-	0.5	-
	P12	TO TL	n	-	0	-	0	-	0.5	1	0.5	-
		T2 T4,9	d n	-	0	-	0	-	0.5	1	0.5	-

TABLE II. DESCRIPTION OF OCCLUSAL CONDITIONS IN BURLINGTON,
ONTARIO, ACCORDING TO FORM OF MALOCCLUSION AND UNDERLYING VARIATIONS
FOR 1200 CHILDREN AGES 3, 6, 8, 10 & 12 YEARS.

CLASSIFICATION			3 Years		6 Years		8 Years		10 Years		12 Years	
Malocclusions	Predisposing or General Conditions		%		%		%		%		%	
	Antero- Posterior Dental Relation	Abnormal Tooth Positions	Tooth Defects	Skeletal and General Factors	% Mal'n's.	no. Variations	% Mal'n's.	no. Variations	% Mal'n's.	no. Variations	% Mal'n's.	no. Variations
M, M M+U M+	P0		TO	n	0	1	0	-	0	-	0	-
			TL	m		2		-		-		-
			TL, 7	m6a		1		-		-		-
			TL, 9	n		1		-		-		-
	P1		TO	n	0.8	1	0.5	-	0	-	0.5	-
				m		1		-		-		-
				m3, 6a		1		-		-		-
				m6		1		-		-		-
	P1, 7		TL, 3	m		1		-		-		-
				m	0	-	0.5	1	0	-	0	-
				n9	0	-	0.5	1	0	-	0	-
				n6a	0	-	0	-	0	-	0	-
	P2, 3, 4, 5		TO	m6a	0.4	1	0	-	0	-	0	-
				m6a	0	-	0	-	0	-	0	-
				n	0	-	0	-	0	-	0	-
				n6a	0.4	1	0	-	0	-	0	-
	P3, 5, 12		TL	m	0	-	0	-	0	-	0	-
				m8	0	-	0	-	0	-	0	-
				m	0.5	1	0	-	0	-	0	-
				m8	0	-	0	-	0.5	1	0	-
	P7, 8		TO	m	0	-	0	-	0	-	0	-
				m	0	-	0	-	0	-	0	-
				m	0	-	0	-	0	-	0	-
				m	0	-	0	-	0	-	0	-
	P8		T6	m	0	-	0	-	0	-	0	-
				m	0	-	0	-	0	-	0	-
				m	0	-	0	-	0	-	0	-
				m	0	-	0	-	0	-	0	-

TABLE II. DESCRIPTION OF OCCLUSAL CONDITIONS IN BURLINGTON,
ONTARIO, ACCORDING TO FORM OF MALOCCLUSION AND UNDERLYING VARIATIONS
FOR 1200 CHILDREN AGES 3, 6, 8, 10 & 12 YEARS.

CLASSIFICATION				3 Years		6 Years		8 Years		10 Years		12 Years	
Malocclusions		Predisposing or General Conditions		% Mal'ns.	no. Variations	% Mal'ns.	no. Variations	% Mal'ns.	no. Variations	% Mal'ns.	no. Variations	% Mal'ns.	no. Variations
		Antero-Posterior Dental Relation	Abnormal Tooth Positions	Tooth Defects	Skeletal and General Factors								
	P10	TO	n8	0	-	0	-	0	-	0	-	0.5	1
	P11	TO	m3	0	-	0	-	0	-	0.5	1	0	-
	P11,12	TO	m	0	-	0	-	0	-	0	-	0.5	1

TABLE III
SUMMARY OF FINDINGS BY AGE

CLASSIFICATION	3 years (n-268) % no of v#	6 years (n-296) % no of v	8 years (n-211) % no of v	10 years (n-206) % no of v	12 years (n-199) % no of v
IDEAL OCCLUSION N,Po, To, n,	23.5 -	24.6 -	4.3 -	3.4 -	5.5 -
NORMAL OCCLUSION N,Po but having predisposing tooth or general defects	10.4 -	32.5 _{&} -	17.5 -	8.7 -	6.5 -
Sub Total	33.9	57.1	21.8	12.1	12.0
CLASS I MALOCCLUSION Neutro antero- posterior dental relation with positional defects	41.1 19	22.9 17 &	52.2 29	60.9 61	54.4 63
CLASS II MALOCCLUSION Distal antero- posterior dental relation with or without positional defects	23.2 15	16.0 14	24.0 22	25.5 31	31.6 43
CLASS III MALOCCLUSION Mesial antero- posterior dental relation with or without positional defects	1.8 4	4.0 5	2.0 4	1.5 3	2.0 4
TOTALS	100 38	100 36	100 55	100 95	100 110

#number of combinations of tooth position defects P1 to P12.

& the six-year group was the initial group experimentally classified and several conditions, particularly overjet (P3), were less critically defined, hence the normal occlusion group is known to be too large.

TABLE IV

RELATIVE FREQUENCY OF SOME SPECIFIC CONDITIONS
ACCORDING TO AGE AND ANTERO-POSTERIOR DENTURE RELATION

OCCUSAL CONDITION	Dental Occ'n Class	3 year	6 year	8 year	10 year	12 year	all ages
Posterior Crossbites							
Maxilla to Lingual P2	I	.09	.13	.07	.11	.08	.09
	II	.05	.06	.04	0	.06	.04
	III#	.25	.17	.0	0	0	.09
Maxilla to Buccal P2b	I	.01	0	0	.01	.01	.01
	II	.02	0	.02	.02	.08	.03
	III	0	0	0	0	0	0
Anterior open bites P2	I	.07	.01	.05	.04	.04	.05
	II	.03	.04	.02	.04	.05	.04
	III	.40	0	0	0	0	.05
Sucking Habits							
Active G6a	Normal	.11	.09	.06	.08	0	.09
	I	.40	.31	.11	.12	.08	.23
	II	.50	.28	.10	.16	.06	.22
	III	.50	.33	0	0	0	.19
Stopped G6	Normal	.03	.09	.19	.20	.21	.11
	I	.05	.03	.20	.20	.26	.16
	II	.01	.08	.34	.16	.19	.15
	III	0	0	0	0	.25	.03
Mid-line Diastema P9	I	0	.07	.05	.03	.02	.03
	II	.03	.02	0	.02	0	.01
	III	0	.08	0	0	0	.03
Premature loss of Deciduous Teeth T1	Normal	0	.11	.19	.36	0	.10
	I	.02	.07	.29	.34	.05	.17
	II	0	.09	.22	.40	.05	.15
	III	0	.04	.25	0	0	.20
Adenoids etc.	Normal	.12	.08	0	.04	.04	.08
	I	.13	.04	0	.10	.05	.07
	II	.21	.02	0	.14	.08	.10
	III	0	.08	0	.12	0	.06
Skeletal	(Normal	.94	.91	.74	.60	.83	.87
Antero-Posterior	(I	.83	.85	.69	.73	.65	.73
Development	(II	.34	.45	.26	.57	.38	.40
	(III	.40	.40	.40	0	.25	.33
	(Normal	.05	.08	.17	.16	.04	.09
	(I	.15	.16	.22	.15	.16	.19
	(II	.68	.55	.64	.42	.61	.60
	(III	0	0	0	0	0	0
	(Normal	.01	.01	.08	.24	.12	.04
	(I	0	0	.07	.10	.18	.09
	(II	0	0	0	.02	0	.01
	(III	.60	.60	.50	1.00	.75	.66

#Rates for Class III occlusion are based on only a few individuals (Table IV), hence figures are only of value in suggesting format of future arrays.

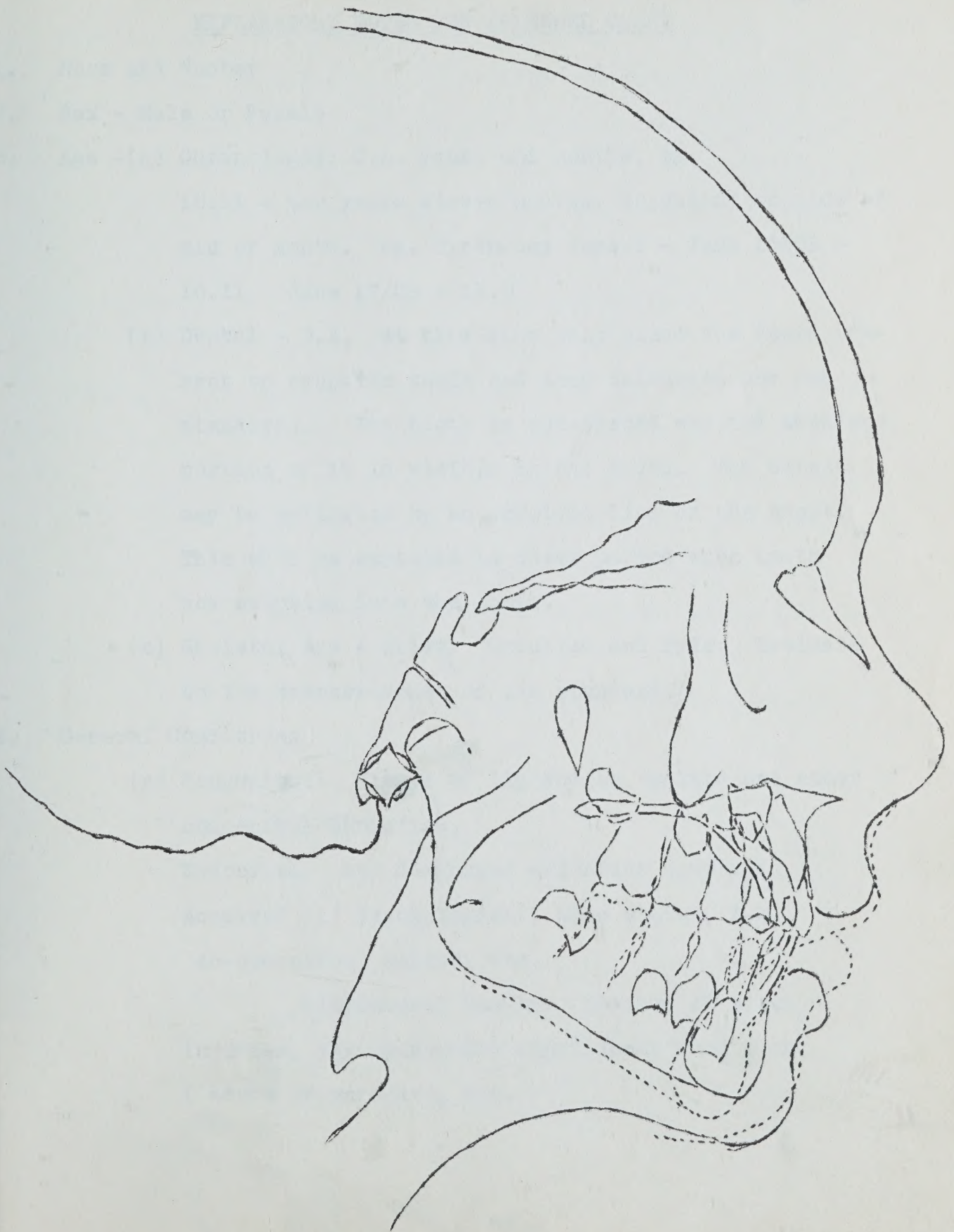
STANDARD TRACINGS AND LEDGER CONSOLIDATION
OF MEASUREMENTS

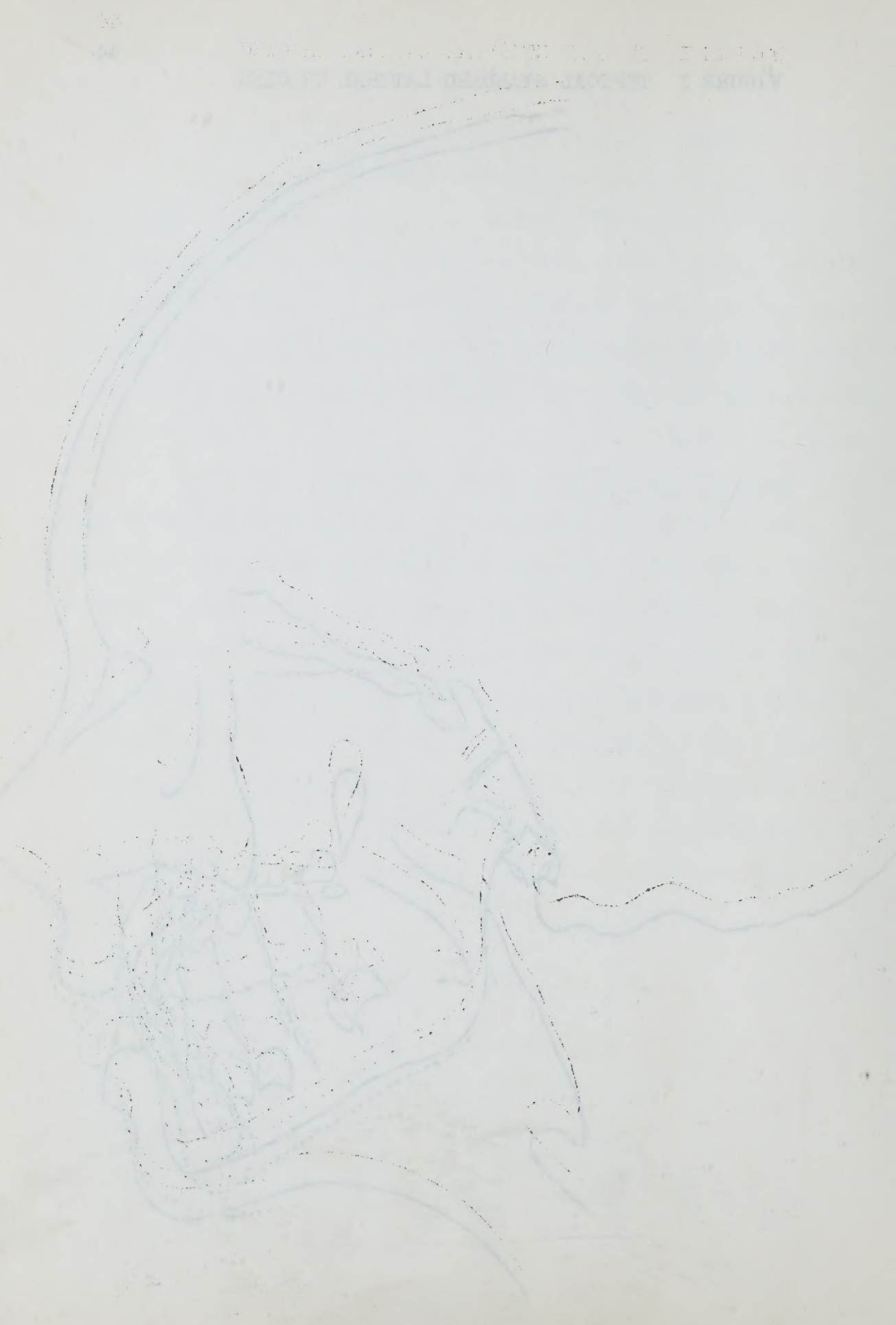
Approximately 2000 standard tracings have been completed for the control group and the serial group to date. The protocol for the standard tracing is given as figure 1 on page 44 (and figure 2 report series No. 2). The criteria for locating the various landmarks and establishing planes are given on page 45 - 59.

Ledger Consolidation of Measurements.

Many measurements have been completed from the standard tracings and dental models. To avoid repetition or loss these have been consolidated on pages of a special ledger. Examples of the ledger book blank pages are bound in as Appendix A and the definition of all measurements or entries on the ledger books is explained in the following section. Control data are grouped by age and sex. Serial group data, i.e. the longitudinal data are entered leaving room below each case for completion of annual recordings.

FIGURE I TYPICAL STANDARD LATERAL TRACING





EXPLANATORY NOTES FOR APPENDED CHART

1. Name and Number

2. Sex - Male or Female

3. Age -(a) Chronologic: C.A. years and months, eg.

10.11 = ten years eleven months, depending on side of mid of month. eg. Birth/day June 1 - June 16/58 = 10.11, June 17/58 = 11.0

(b) Dental - D.A. At this time only place the teeth present on eruption table and then calculate our own standards. The tooth is considered erupted when any portion of it is visible in the mouth. The extent may be estimated by an eruption line on the chart. This will be expanded to cover period when teeth not erupting into the mouth.

(c) Skeletal Age - Wrist: Greulich and Pyle: Estimate to the nearest month of the standard.

4. General Conditions

(a) Congenital: Clefts of lip and/or palate and other congenital anomalies.

Endocrine: any diagnosed endocrine condition.

Acquired (i) Psychological: home status, I.Q., co-operation, habits, etc.

(ii) General Health: History of birth injuries, any reasonably significant condition (acute or chronic), etc.

5. Cephalograms - (Cephalograms are taken at a five foot target to subject distance. Laterals are taken at 15.0 cms., and obliques at 14.0 cms., subject to film distance. A-P's are recorded with the nose and forehead in contact with the bucky.) Tracings of lateral cephalograms are all mid-planed.

Measurements - Linear to nearest 0.1 millimetre.

Angular to nearest 0.5 degree.

Lateral - (a) Angular (i) Natural occlusal plane to Bolton-Nasion. Occlusal plane constructed along buccal segments (through interdigitating cusps) use incisors if anterior section of the segment is questionable. The last erupted tooth in the mouth is taken as the posterior reference point of the buccal segment.

(ii) Upper central incisors to natural occlusal plane.

(iii) Lower central incisors to natural occlusal plane.

(b) Linear - (i) Skeletal: Cranial base length - Bolton to Nasion.

(ii) Cranio-facial relations: (All landmarks projected on to average "cranio-occlusal plane of 38.0° and measurements made at right angles to this plane."

Maxilla - Sella to PTM - Sella point being the centre of the hypophyseal fossa. (Pterygo Maxillary Fissure point being the inferior junction of the anterior and posterior wall of pterygo-maxillary fissure).

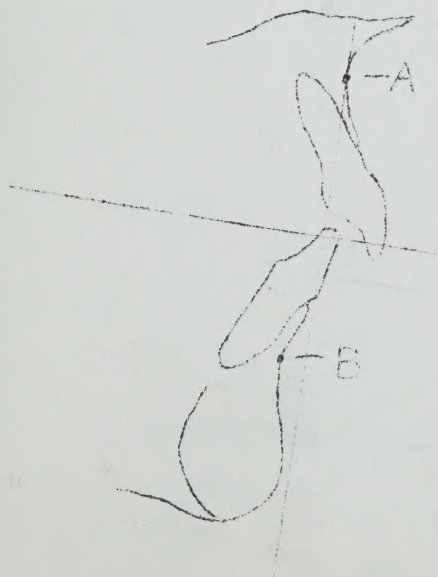
Mandible- Sella to C - C being the most posterior surface of the condyle.

Maxillary and Mandibular Dimensions

Maxillary Length - PTM to A: A Point being the deepest point in the concavity of the maxillary anterior profile (ANS to prosthion) in the mid-line.

Mandibular Length - C to B Point: - B Point being the deepest concavity in the mandibular anterior profile (infradentale to pogonion) in the mid-line. If this anterior profile is flat the vertical mid point of the flat area is taken.

A/B Relation - to natural occlusal plane.



Denture to Skeleton

MAXILLA : PTM - $\underline{e}$ (distal margin of $\underline{e}$)

$\underline{e}$ to A distal margin of $\underline{e}$ to A Point

$\underline{l}$ to A plane; incisal tip of upper central incisors to A plane.

MANDIBLE: C - $\underline{e}$; most posterior portion of condyle to the distal margin of $\bar{e}$

$\underline{e}$ - B ; distal margin of $\underline{e}$ to B Point

$\underline{l}$ to A plane ; incisal tip of the lower central incisors to A plane

Degree of Convexity: from A to N-B line, measured in mms. and degrees as ANB angle.

Vertical - Freeway Space - mms. of free way space measured incisal tip to incisal tip - rest and occlusion. (at right angles to the natural occlusal plane.)

(A - P) Anterior - Posterior Cephalogram

Reference Centre Line: First a line is drawn joining the lateral margins of the Zygomatic Frontal Sutures. The centre line or x-line is then constructed by drawing a line at right angles to the z-f line through the base of Crista Galli.

- (a) Skeletal: (Note the amount that the head is turned and the clarity of the two Frontal Zygomatic Sutures. If the head is not badly turned use Sassouni's points (intersection of the medial walls of the superior temporal fossae and the lateral walls of the orbits) as a check. If the head is sufficiently rotated that the distance from the orbit to the lateral cranial surface on the greater side is over one half again as wide as the lesser, then designate the film as "inferior"; if the distance is three times as wide on the greater side designate the film as "useless".

Right side - positive reading

Left side - negative reading

(i) Maxillae - Anterior nasal spine and zygomatic-maxillary suture.

(ii) Mandibular -The point between apices of the lower central incisors

Gonial Angles (grid at 70° - a line tangent to the gonial angles drawn at 70° from the Z-F line)

(b) Dentures

(i) Maxillary centre line between the upper central incisors at the alveolar crest-prosthion (supradentale)

Alveolar point - alveolar crest on the lateral margin of of e's or 6's, if erupted. (The last molar erupted is used). If the alveolar point is too difficult to establish, then use the most lateral portion of the last molar erupted, noting the measurement used.

(ii) Mandibular - Centre line between the lower central incisors at infradentale. (Lateral alveolar point of the lower second deciduous molars or the lower first permanent molars.) When the alveolar point is too difficult to establish then the most lateral portion of the last erupted molar is used. The measurement used is noted.

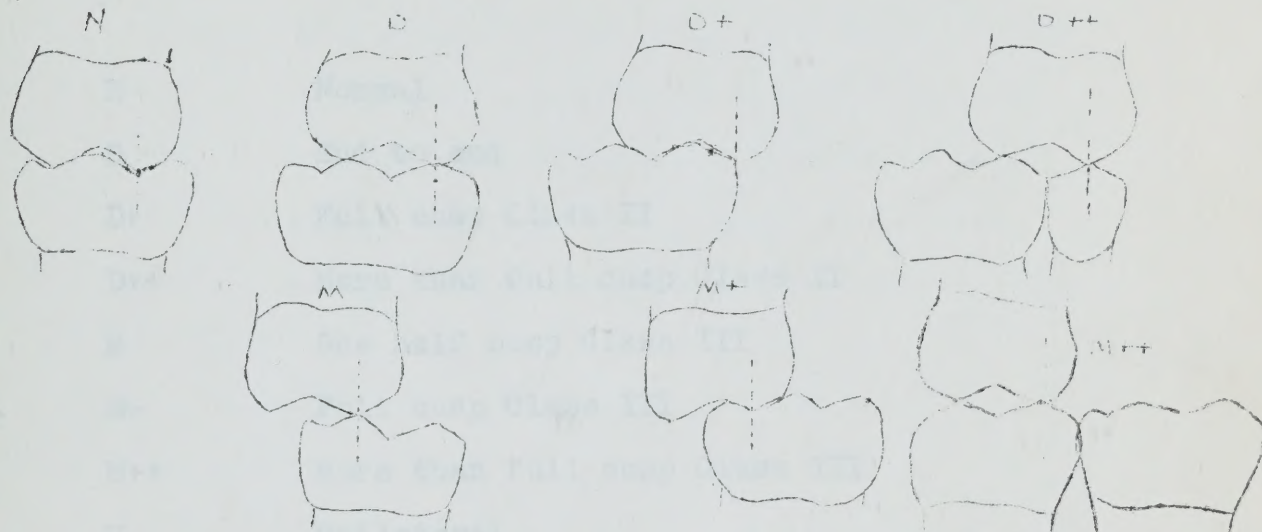
Dental Unit Shift - Upper Anterior Nasal Spine to the incisal tip contact point of the upper central incisors deciduous or permanent at the incisal tip.

Lower GT (Genial tubercle) or Infradentale to the incisal tip contact point of the lower central incisors.

6. Inter Denture Relation

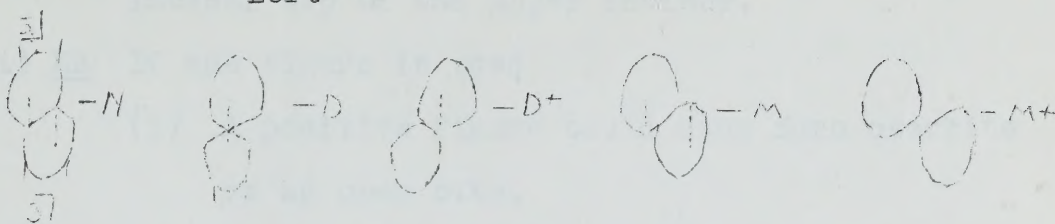
Anterior Posterior

- (a) Molar - Right: If a case is more than 50% towards
 OR Left : an end to end or full cusp relation
 it will be designated as such.



Vertical line represents the middle of the range for each classification.

(b) Cuspid Right
 OR
 Left



N	Normal
D	End to end
D+	Full cusp Class II
D++	More than full cusp Class II
M	One half cusp Class III
M+	Full cusp Class III
M++	More than full cusp Class III
U	Unilateral

(c) Overjet - as a mean of the right and left central incisors. (Note: if the difference is reasonably great - over 2.0 mms. - both centrals are dotted in on the tracing.)

(i) 0 - 4.5 = positive overjet (zero at the labial surface of the lower incisors and always greater figure at labial surface of the upper incisor.)

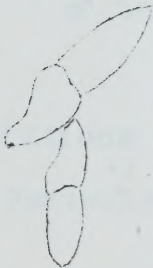
(ii) 4.5 - 0 = Negative overjet or x-bite. Greater figure at labial incisal surface of the

lower incisor, and almost always zero at labial incisal tip of the upper incisor.

(iii) NB If one figure is used

(1) A positive figure could mean zero overbite or an open bite.

(2) If a negative figure is used it could possibly mean a x-bite as in cleft palates, and therefore inability to measure the second figure. eg. could be written as 4.0 - 0 by estimating the lingual figure.



Cross-bites and Malposed Teeth.

If less than half of the anterior segment or posterior teeth are in cross bite, then they are designated as malposed teeth (interfering with function) and overjet is designated as positive.

If more than half of the anterior or posterior teeth are in cross-bite, then the anterior overjet is designated as negative, and in the posterior as a cross-bite.

Vertical - Open-bite and Overbite.

(a) Open-bite - (i) Anterior in mms. taken off models and checked by cephalograms, measured at right angles to the natural occlusal plane.

(ii) Posterior open-bite in mms. taken off models and checked by cephalograms.

Specify teeth that are not in contact (anterior or posterior teeth). Greatest open-bite measurement is recorded.

(b) Overbite - Measured on models as a mean average of the two central incisors. eg. $\frac{4.0}{8.0} - \frac{O/B}{\text{Crown length}} = 50\%$

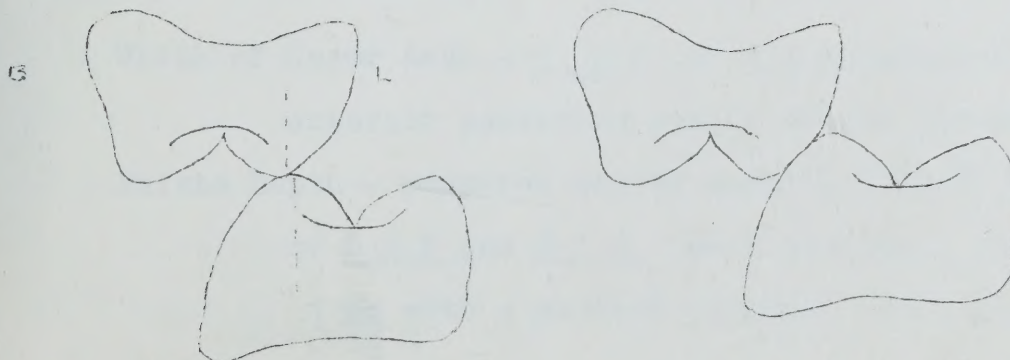
Lateral Relations of Buccal Segments

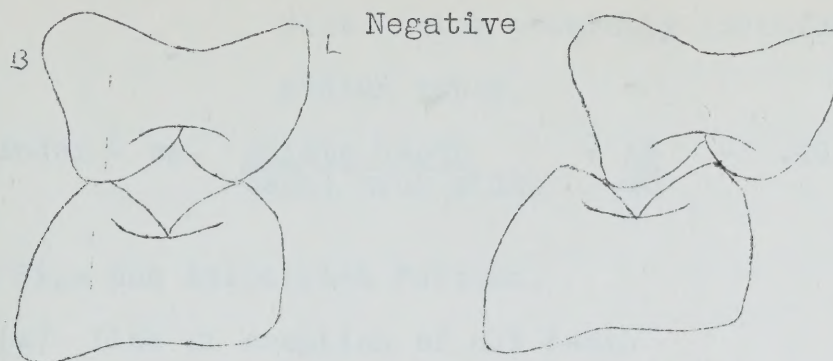
Posterior cross-bite (a) Positive - upper segments buccal to lowers.

(b) Negative - upper segments lingual to lowers.

Specify teeth involved.

Positive





Arch Width

Upper Molar - gingival margin of the lingual groove of the upper second deciduous molars and /or the first permanent molars.

Cuspid - centre of the tooth mesio-distally at the gingival lingual margin.

Lower Molar - gingival margin of the lingual groove of the lower second deciduous molars and / or the first permanent molars.

Cuspid - Centre of the tooth mesio-distally at the gingival lingual margin.

Base Width to Arch and Index

(C.F.) Canine Fossae - on models at apices of d / d or 4 / 4

Width of Upper Arch - d / d or 4 / 4 measured from the anterior posterior centre tip of buccal cusps.

Palate Depth - measured across central pits of e / e or 5 / 5 and 6 / 6 when present. Measuring is done with a slotted occlusal metal plate, the

slot being centrally positioned over the
median raphe.

$$\text{Index - eg. } \frac{\text{palate depth}}{\text{basal arch width}} = \frac{16}{40} = .40$$

Tooth Size and Associated Factors.

- (a) Line of eruption of all teeth
- (b) Mesio-distal widths of the deciduous and the permanent teeth to the nearest tenth of a millimetre, (correct contact to correct contact.)
- (c) Signs to designate
 - (i) Supernumerary S
 - (ii) Missing teeth ☐
 - (iii) Teeth extracted ☒
 - (iv) Teeth broken down by caries, affecting occlusion 0
 - (v) Crown cannot be restored x
 - (vi) Crown cannot be restored and caries affecting occlusion ☒

Upper and Lower Arch Length - measured with a plastic rule to nearest 0.5 mm., Mesial of 1st permanent molar to mesial of opposite 1st permanent molar: measured through the contacts as they exist or should exist as in good occlusion.
eg. if several teeth are blocked out of position then ignore and designate these teeth out of position.

Sum of the Width of the Teeth in the Upper and Lower Arches.

- (a) Measure individually in deciduous and permanent dentitions only when teeth are fully erupted.
- (b) Use mixed dentition analysis during mixed dentition stage.

NOTE: In the very early mixed dentition stage, of the cross section group, measure the size of the upper and lower incisors on AP, and in that way carry out a mixed dentition analysis, as an estimate which should be noted and rechecked upon eruption of these teeth. This method is not used if the central and lateral incisors are rotated.

Difference = Arch length minus the sum of actual tooth widths or their estimated widths.

Space Loss = Mesial and distal drifting; measured in the upper and lower arch as space loss per quadrant. This space loss will probably be a combination of both mesial and distal drifting of teeth.

Individual Tooth Position in the Mouth.

Malposition of the teeth to the extent that it interferes with or does not serve with normal functions, eg. x-bite, over-erupted, submerged, ectopic eruption and transposition.

Individual Malposition of Teeth before Eruption -

Teeth obviously out of position or as in palatally positioned cuspids etc.

General - Tooth defects, hypoplasia, uncontrolled caries, missing, early loss, individual tooth defects.

Periodontal Tissues - Frenum, recession, diastema, ankylosis, and or over retained teeth.

Occlusal Classification - should be based upon models and remarks as to skeletal type.

- (1) Normals - Those with classified dental occlusions as N, D, M, with less than 1.5mm. average crowding per quadrant in each arch, or overbite not greater than 50% and overjet not greater than 4.0mm.
- (2) Class I - Posterior and anterior cross-bites: crowding of more than 1.5mm. per quadrant, in each arch, overbite greater than 50%, overjet greater than 4.0mms. - eg. overjet of 1.0 - 4.0 is classified as greater than 4.0mms.; overjet of 0.0 - 4.5 is classified as greater than 4.0 mms.
- (3) Class II Division I - Classified D+ or D++, in cuspid and or molar relation; overjet greater than 4.0mms.

Division II - Classified D+ or D++

in cuspid and or molar relation; overjet
less than 4.0 mms.

- (4) Class III - Those classified with M+ or M++ in
cuspid and molar relation.

Note: Any unilateral condition will be designated by
a U as designated on page 12.

Studies in Genetics.

The report which is appended entitled "Dental Genetics", was presented by the writer at the Tenth International Congress of Genetics. This report from work at the Clinic served to illustrate the type of investigation which is being conducted in an attempt to clarify the effects of heredity in the maturation of the individual with particular reference to the process of eruption and characteristics of the teeth.

In the last paragraph of this paper "Dental Genetics" and also that of the one entitled "A Comparison of Eruption, Occlusion and Development of the Facial Skeleton" (page 67 of this report) reference has been made to the necessity for carrying out a study aimed at establishing the mode of inheritance of certain cranial and facial characteristics. As Krogman (1958) has clearly indicated genetic knowledge is of value to the practitioner from an "anticipatory" as well as a "prognostic" point of view. In the opinion of the present writer it seems incredible that an attempt could be made to treat a case without even so much as a look at both the child's parents, particularly in cases where the problem is clearly not of a dental nature! At present, if an orthodontist does carry out careful observation of the parents he may derive very valuable information regarding the stages of adulthood which the

child will assume through his own inherent genetic pattern. In contrast to this general sort of information which the clinician may or may not acquire for himself is that which the study mentioned above should provide. Since the aim of such a study is to determine the mechanism whereby certain characteristics are actually transmitted, the results will, it is hoped, assist the clinician in the preparation of a treatment plan which should be considerably more precise.

Included in the Clinic's files are six hundred families all of whom have at least two siblings with complete records. Records of the parents of children in the serial group are also being collected. At present complete pedigrees of all the children included in the Clinic's files are being assembled. The next consideration will involve the classification of each individual in each pedigree according to certain significant characteristics of the facial skeleton. Finally an attempt will be made to determine whether or not certain characteristics occur in families in such a way as to make possible the clarification of the genetic mechanism involved. It should be pointed out that whereas twin studies are ideally suited for establishing heritability values, only a familial study which makes use of complete pedigrees of several generations will provide the

answer to the mode of inheritance of certain characteristics.

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- Krogman. W. M. The Meaningful Interpretation of Growth
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Am. J. Orthod.: 44: 411 -432 June, 1958.

Dental Genetics.

This exhibit is designed to demonstrate an area of genetics which, until recently, has been somewhat lacking in systematic investigation.

Of the more valuable contributions to dental genetics recently made, a few deserve particular attention. In his report on "The Genetics of Human Dentition" Kraus (1) clearly indicates the significance of tooth morphology and its immediate application to the study of twins. The same author (2) has used to advantage the data derived from six sets of triplets in the attempt to determine heritability values for the morphology of certain bones of the skull and face. Horowitz, Osborn and De George (3) have illustrated the extent to which hereditary factors govern tooth size.

In 1955 Hatton (4) established heritability values for the eruptive time of certain deciduous teeth. At the Burlington Research Centre (Burlington, Ontario, Canada) studies are now being conducted on the various stages in the process of eruption of the permanent teeth, use being made of serial records derived from twins, sibs and single births. Observations based on the lower six year molars indicate that two factors, namely size (medio-distal width) and the rate at which these teeth move from their crypts

in the jawbone to their fully erupted position in the mouth are governed by the action of genes. Teeth larger than average appear to move more slowly than those smaller than average. Moreover at three years of age there exists a wide range (14.4 mm. - 18.6 mm.) in the position these teeth above the inferior border of the mandible. This position appears to have no bearing on the time when the teeth appear in the mouth, thus indicating the significance of the rate at which they are able to move toward their occlusal position. A measure of the degree of symmetry for pairs of homologous teeth derived from laterality values for size, position above the inferior border of the mandible and rate of movement toward their occlusal position, is yet another aspect of the process of eruption that is being considered.

Included in the Burlington Clinic's files are records showing the growth and development of children from 500 families. Single sets of records are also available for their parents. By means of analyses of the pedigrees it is hoped that the genetic mechanisms involved in governing certain facial and cranial patterns may be established.

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1. Kraus, B. S. The Genetics of Human Dentition. J. Forensic Sc. October, 1957.
2. Kraus, B. S. Heredity and The Cranio-facial Complex (Personal communication, paper now in press).

(continued)

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3. Horowitz, S.L., R.H. Osborn and F.V. DeGeorge
Hereditary Factors in Tooth Dimensions,
Angle Orthodontist, April, 1958.
4. Hatton, M.E., A Measure of the Effects of Heredity and
Environment on Eruption of the Deciduous
Teeth. J. Dent. Res., June, 1955.

Dental Genetics

The treatment of occlusal defects in children, including incipient cases, requires a knowledge of growth and development.

The relative effects of heredity and environment are revealed in a study of the dental models of twins

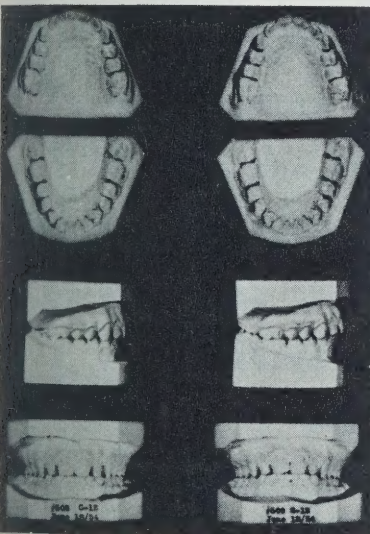
Tooth characteristics to be considered-include:

1. Eruption.....
2. Number.....
3. Size.....
4. Morphology.....
5. Angulation.....
6. Alignment.....
7. Occlusion.....

The various types of teeth (such as the central and lateral incisors, cuspids or molars) may each have a strong genetic component of variability for these three characteristics. Environmental influence has little effect.

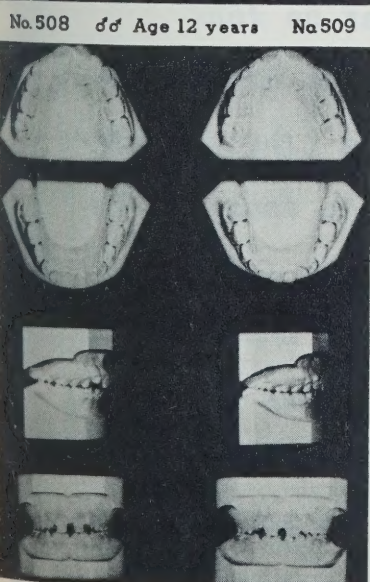
Though under the control of gene action, these three characteristics can be markedly affected by non-genetic factors.

Monozygotic Twins



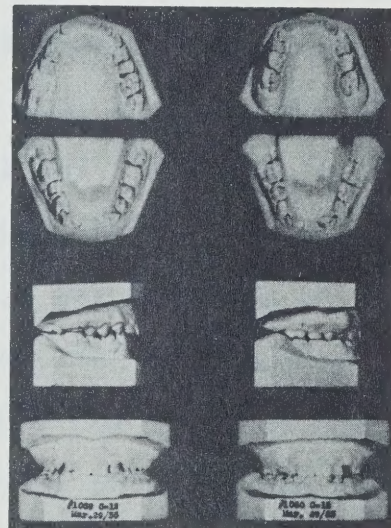
Note the marked degree of concordance for tooth eruption, size, number and morphology.

← Tooth angulation, alignment and occlusion are all markedly alike, although all may be influenced by non-genetic factors.



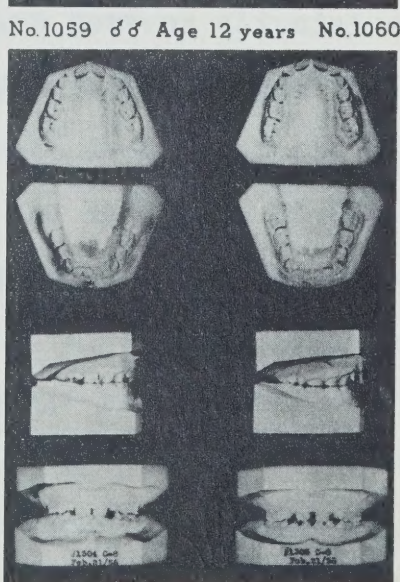
The above comments apply to these monozygotic twins.

Dizygotic Twins



← Tooth eruption, size, number and morphology show marked discordance.

← Tooth angulation, alignment and occlusion are clearly dissimilar.



The above comments apply to these dizygotic twins.

No. 847 ♀♀ Age 8 years No. 848

No. 1304 ♀♀ Age 8 years No. 1305

A Comparison of Clinical Eruption, Occlusion and Development of the Facial Skeleton in a Group of Neutroccclusion and Class II Malocclusion Cases.

Introduction

Amongst studies of maturation few problems have received more attention than those which are involved not only with the process of eruption, but also the possible relation between the sequence of eruption and the development of occlusion. In 1953 Lo and Moyers discussed what they described as favourable and unfavourable sequences depending upon the type of occlusion with which these sequences were associated. The results reported earlier by MacGregor (1946) and Speidel (1949) are also in accordance with those of Lo and Moyers. The findings of these investigators serve to show the diagnostic value of eruptive sequence and at the same time they emphasize the need for further clarification of the interdependence of these two phenomena.

That an association does exist between clincial eruption and growth of the jaws was pointed out by Hellman in 1923. Baker (1941) and Markus (1942), have shown that the final development of the jaws is under the influence of the developing dental organs. Gruneberg (1936) and Ford and Mason (1943), explain the close association which they observed between eruption and bone growth as being the result of a complex of genetic factors. Diamond (1944) is of the opinion that there is no cause and effect relation between the growth and devel-

opment of the teeth and the growth and development of the jaws, even though, "There is a factor of spatial interrelation between the growth of the jaws and clinical eruption of the teeth". Sicher and Weinmann (1944) and Gruneberg (1936) make it clear that there is in fact an intimate association between the growth and development of the tooth and the adjacent bone metabolism, "We are forced to look upon tooth movement as an integral part of the elaboration of the growth pattern of the jaws and to consider growth of bone as the "force" which moves the teeth." (11) In view of the complex nature of the process of eruption (Dienstein 1956, and Bryer 1957) of which the appearance of the teeth in the mouth is but a single stage, and because of the multitude of factors which affect occlusion, any attempt to relate the two phenomena requires careful analysis. It will not be denied that malocclusion is sometimes the direct result of the adjustment of the bite to some peculiarity in eruption. It would appear that in such cases the growth and development of the dental organs are the controlling factor in the development of occlusion. At the same time it is obvious that occlusion is also influenced by the growth and development of the skeleton. A review of the findings of several investigators, some of which have been mentioned above make it perfectly clear that tooth movement and bone growth are intimately associated. The real problem here is in trying to determine the relative importance of the two processes in their effect

on occlusion.

Problem

The aims of this pilot study were three-fold. First it was necessary to establish the occlusion of each child making up a representative sample of six year old children taken from the Burlington population. Using only the neutroccclusion and class II malocclusion cases the presence or absence of the first four permanent molars (in clinical eruption) was noted. Finally an attempt was made to determine whether or not these two samples differed significantly not only in the eruption of the first permanent molars but also in the size of certain dental and skeletal characteristics.

Sample

The cases used for this study were 154 boys taken from the six year old control sample included in the clinic's records. Like the eight, ten and twelve year old control samples these children were considered to be a representative group. The records of each child had been taken as close to his sixth birthday as possible. The average age of the sample was found to be 6.1 years.

Observations

Type of Occlusion Using the Angle system of classification, occlusion was based on the cusp relation of the teeth in the buccal segments of the arch.*

* The author wishes to thank Doctor Malcolm Johnston for his determination of the type of occlusion of each child.

Clinical Eruption Presence or absence of the first permanent molars was derived from the dental models.

Dental Measurements. Three sets of mandibular measurements were taken from the dental models. These were:-

Tooth size. The mesio-distal width of $\frac{6}{6}$

Arch width. Width of the arch between $\frac{e}{e}$ at the gingival margin just posterior to the distal fossae.

Arch circumference. Distance from $\frac{e}{e}$ to $\frac{e}{e}$ taken through the contact points of the teeth in the arch.

Skeletal Measurements. Using the cephalometric radio-grams five sets of measurements were made. The lateral head plates provided the following:-

Maxillary length. Distance between PTM and A point

Mandibular length(1) Distance between the anterior border of the ramus and B point, projected on to the natural occlusal plane.

Mandibular length(2) Distance between posterior border of the condyle and B point, projected on to the natural occlusal plane.

The posterior-anterior head plates provided the following:-

Maxillary width. Distance between the two most concave points on the maxillary buttresses.

Mandibular width. Distance between the two most convex points on the gonial "angle".

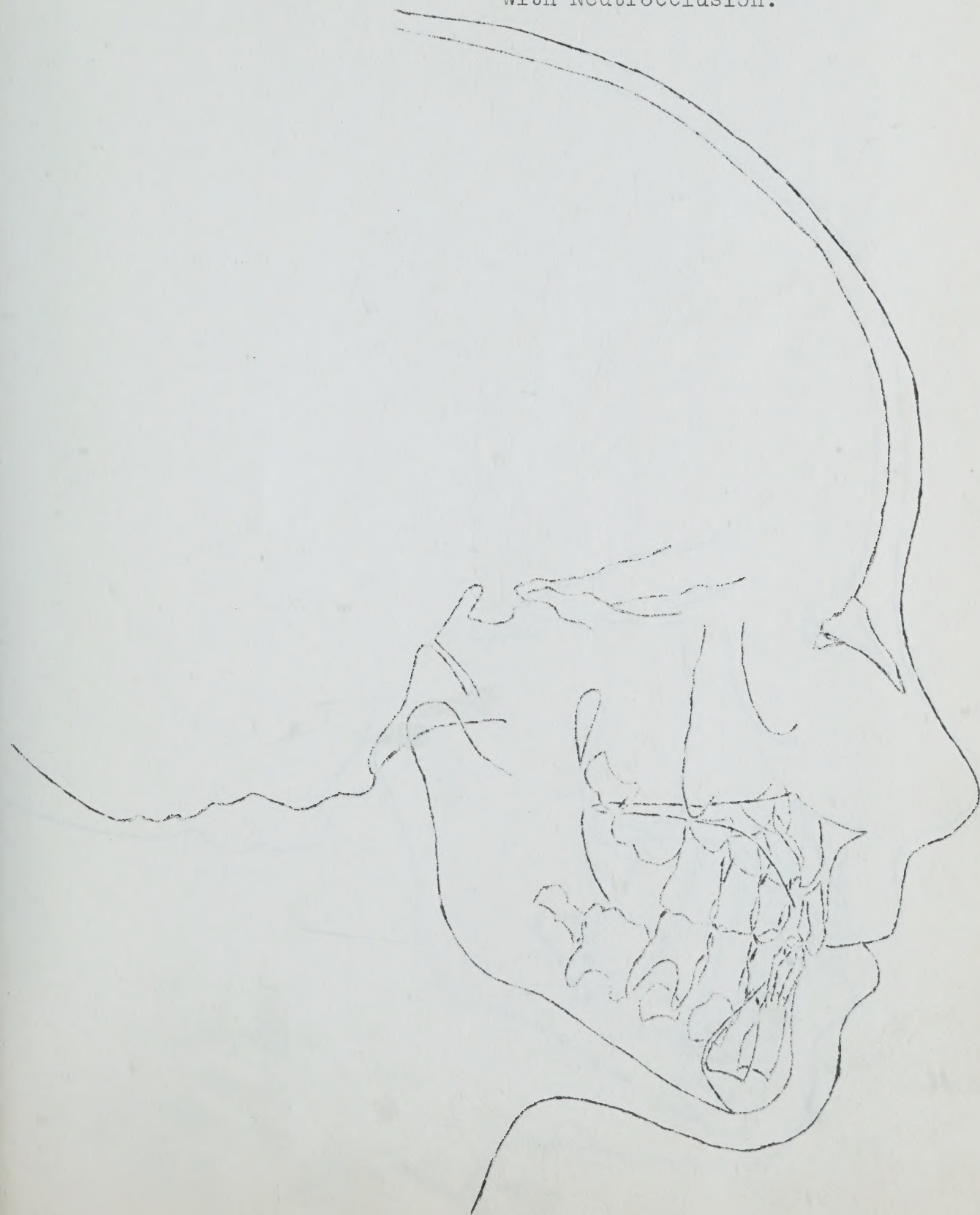
The measurements from the lateral head plates were taken from tracings of the structures; those from the posterior-anterior cephalograms were made directly. Measurements of the teeth were made by means of a Boley gauge, those of the arch were carried out by means of a thin plastic ruler. All measurements were in millimetres.

Results

It is clear from the results shown in Table I that the Class II (Div. I and II) maloccluded children have a much greater number of teeth, (both upper and lower), in the mouth at 6.1 years of age than do the normals. The percentage of eruption of the first permanent molars for the maloccluded group is 55.7; that for the normals is 29.0. The difference between mandibular and maxillary teeth erupted is 5.46% in favour of the lowers for the normals compared with 1.28% in favour of the lowers for the abnormal.

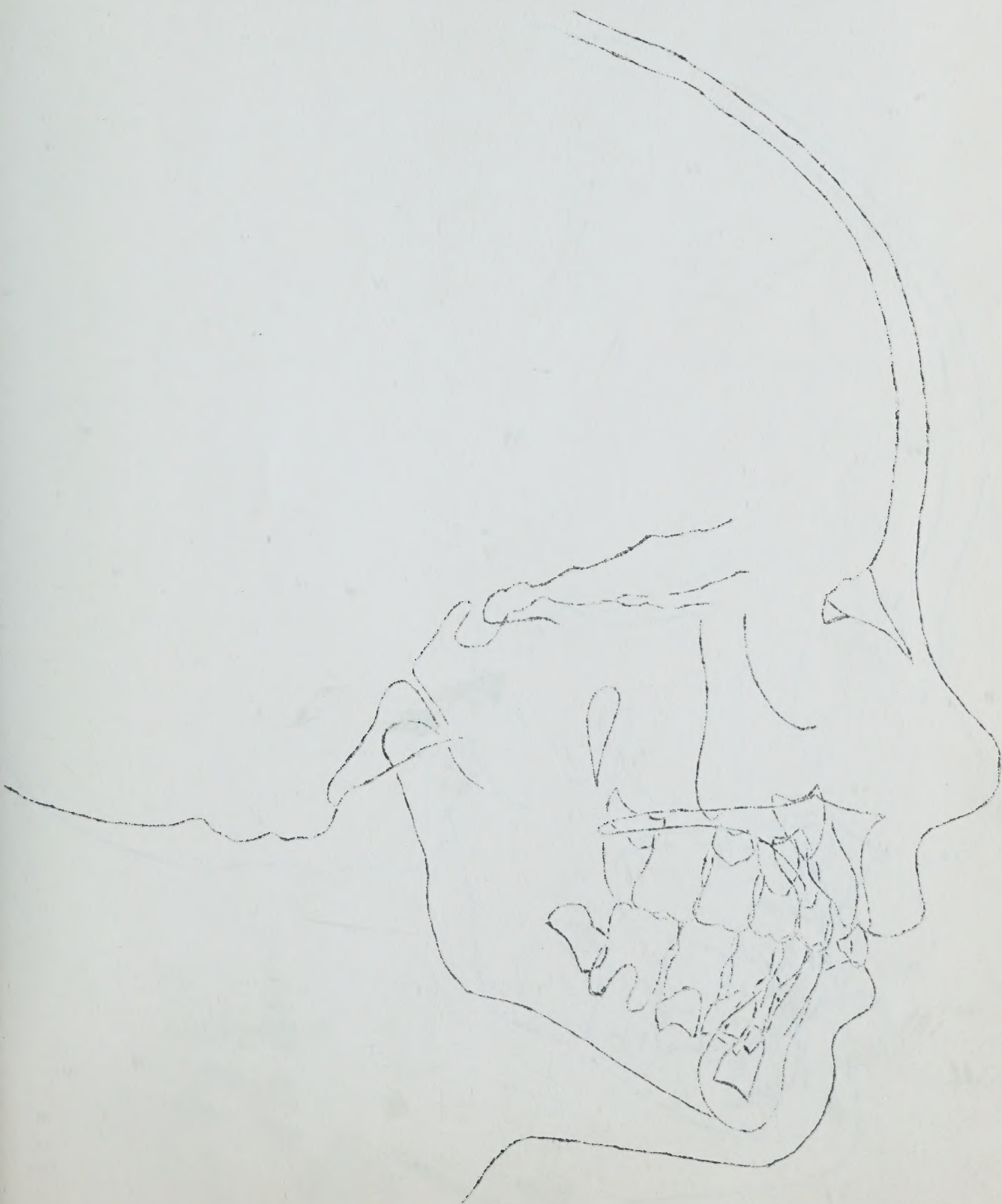
Results shown in Table II reveal that there are also dental and skeletal differences between the two groups of children. The maloccluded children (here Class I, Division I only) have mandibular first permanent molars that are 0.26mm. larger (a difference which borders on significance), a mandibular dental arch width which is 1.13mm. narrower, and a mandibular dental arch circumference which is 2.06mm. shorter than the normal children. These differences are

Profile of a Six Year old Male Child
with Neutrocclusion.



Profile of a Six Year old Male Child

with Class II Division I Malocclusion.



Profile of a Six Year old Male Child

with Class II Division II Malocclusion.

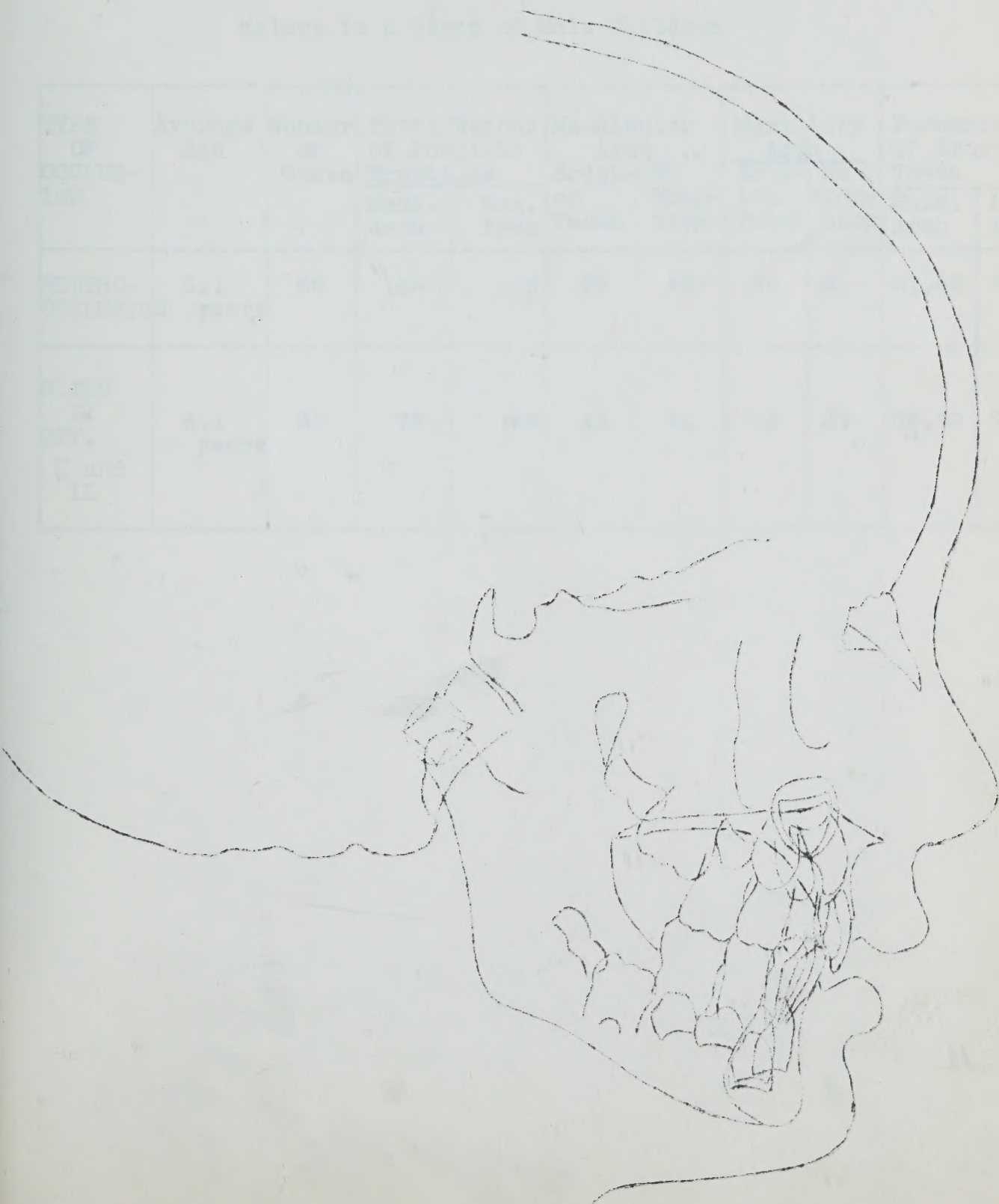


TABLE I

The Distribution of Erupted and Unerupted First Permanent
Molars in a Group of Male Children

TYPE OF OCCLUS- ION	Average Age	Number of Cases	Total Number of Possible Eruptions		Mandibular Arch		Maxillary Arch		Percentage of Erupted Teeth	
			Mand. Arch	Max. Arch	Erupt- ed Teeth	No Erup- tion	Erup- ted Teeth	No Erup- tion	Mand. Arch	Max. Arch
NEUTRO- OCCLUSION	6.1 years	55	110	110	35	75	29	81	31.80	26.34
CLASS II DIV. I and II	6.1 years	39	78	78	44	34	43	35	56.40	55.12

Table II Mean Measurements for Three Dental and Five Skeletal Characteristics. Values for Tests for Significance are also shown.

CHARACTERISTIC		NEUTROCCCLUSION (A)				CLASS II, Div I & II		Class II, Div I only (B)	
DENTAL #		N	$\bar{X}$	s	S $\bar{x}$	N	$\bar{X}$	N	$\bar{X}$
TOOTH SIZE	Rt.	25	10.71	.573	.1161	25	10.96	24	10.92
	Lt.	25	10.65	.541	.1082	25	10.96	24	10.92
MANDIBULAR ARCH									
WIDTH		40	37.25	1.664	.263	25	36.83	24	36.12
MANDIBULAR ARCH									
CIRCUM.		40	71.35	3.266	.516	25	69.83	24	69.29
SKELETAL (from cephalograms)									
MAXILLARY LENGTH		39	51.19	2.167	.347	32	51.49	24	51.35
MANDIBULAR Length (1)		40	42.09	2.142	.338	31	41.28	23	41.01
MANDIBULAR Length (2)		40	82.88			32	80.85	24	80.88
MAXILLARY WIDTH		40	66.37	2.434	.384	32	66.90	24	66.62
MANDIBULAR WIDTH		40	84.35	4.590	.725	32	83.94	24	83.45

#from models

KEY N - number of cases: $\bar{X}$ - Measurement in mm.

s - absolute variability (not used in this study)

S $\bar{x}$ - standard error

Tooth size - the mesio-distal width of

$\overline{o \downarrow o}$

Mandibular arch width = width of the dental arch between $\overline{e \downarrow e}$

Mandibular arch circumference = Distance from $\overline{e \downarrow}$ to $\overline{e \downarrow}$ taken through the contact points of the teeth in the arch.

Maxillary length - distance between PTM and A point

Mandibular length (1) - Distance between anterior border of ramus and B point

istics in Neutroccclusion and Class II malocclusion male children

Diff.between (B) & (A)	't' test		P	Comments on significance
	d	't'	value	
+ 0.25	0.26	1.715	.10	) Bordering on significance
+ 0.31	0.32	1.970	.05	
-1.13	0.92	2.086	0.02	Significant difference
-2.06	2.42	2.72	0.01	Significant difference
+0.16				
-1.08	1.01	1.634	0.10	Insignificant
-2.00	1.65	1.504	0.20	Insignificant
+0.25				
-0.90	1.1	0.870	0.30	Insignificant

Mandibular length (2) - Distance between distal border of the condyle and B point.

Maxillary width - Distance between the two most concave positions of the maxillary buttresses

Mandibular width - Distance between the two most convex positions of the gonial 'angles'

d - difference between the means in the 't' test

significant. In this study no significant difference could be found between the two groups for skeletal characteristics, nevertheless differences were observed. The mandibular skeleton of the Class II cases was found to be smaller. In these individuals the distance between the anterior border of the ramus and B point is 1.08mm. shorter, and that between the posterior border of the condyle and B point is 2.00mm. less than in the normals. The maxillae of the maloccluded group tend to be larger though only slightly. These children are 0.16mm. larger between PTM and A point and between the maxillary buttresses they are 0.25mm. wider than the neutroocclusion cases.

Summary

A pilot study comparing occlusion, eruption, and characteristics of dental and skeletal development has been conducted on a representative group of male children whose average age was 6.1 years. From a total sample of 154 children, 55 were found to have normal occlusion, 39 class II (Division I and II) malocclusion. The latter group of cases differ from the former in having a far greater number of first permanent molars in the mouth at 6.1 years of age. The distribution of upper and lower teeth is about equal in the maloccluded group, whereas the neutroocclusion cases were found to have 5.5% more mandibular than maxillary

teeth in clinical eruption.

In a comparison of dental and skeletal characteristics among neutroccclusion and Class II Division I, cases only, differences were also observed. The abnormal children were found to have larger mandibular first molars in arches which were reduced in width and circumference compared with the normals. These were significant differences. In their skeletal development the Class II children were also found to be lacking, mandibular length and width being smaller, though not significantly different from the normals.

Conclusion

Although it must be emphasized that this is a report of a pilot study, nevertheless, the results obtained are not without their significance. Class II maloccluded children (see figures II and III) have been observed to be significantly different from neutroccclusion cases (see figure I) in a number of quite basic expressions of their general maturation. Moreover, these affected children show a disparity between tooth size and dental arch dimension, in addition to a mandibular and maxillary skeletal relation which is disproportionate compared with the normals. If in a more refined study (one in which Class II Division I, Class II Division II and neutroccclusion cases were compared) it were possible to obviate the effects of environmental

factors (a consideration too frequently oversimplified), then the problem resolves itself into being a determination of how extensive and how significant are the differences between these three groups of individuals. In the opinion of the writer this consideration is of prime importance. The observation that some individuals erupt their teeth in an order quite different from the norm and at the same time reveal a disparity in skeletal development a greater number of time than would be expected by chance alone, serves to emphasize not only the intimate association which is known to exist between tooth movement and bone growth but is also very strong evidence in favour of the assumption that these effects are the result of different genetic factors. In the final analysis the problem is not one of trying to determine the relative importance of eruption and growth of the skeleton in the formation of occlusion, but rather in trying to determine the mode of inheritance of certain growth patterns the particular elaboration of which results in a certain type of occlusion.

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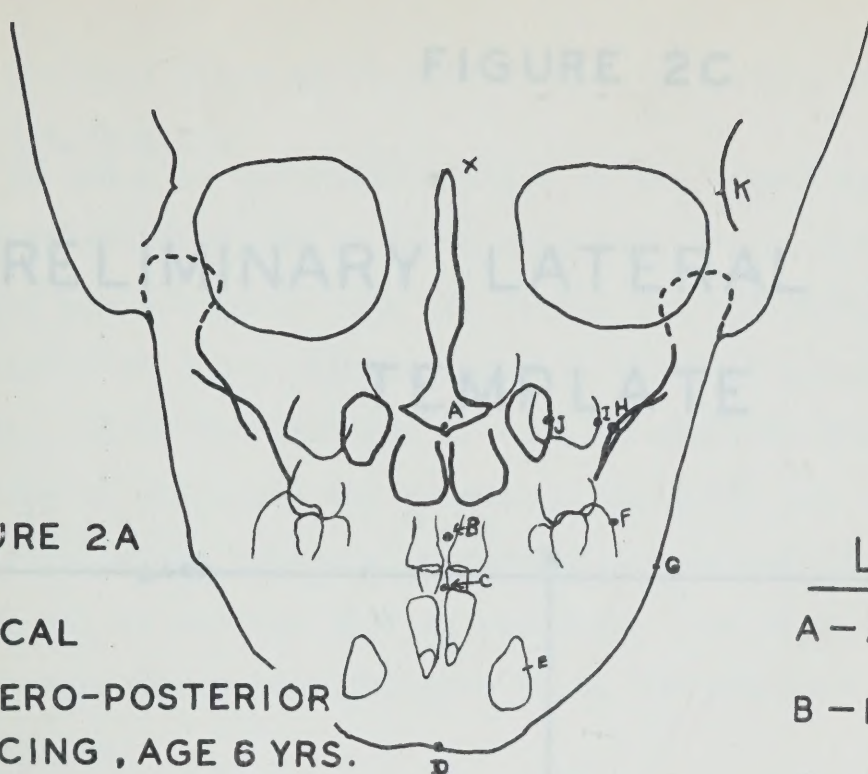
B. Graphic Analysis of Antero-Posterior Head Plates

Following the method used to produce figure II in Report Series 2, a preliminary exploration was made of the growth changes for the following landmarks over ages 3, 6, 10 and 12 years, see figure 2.

Characteristics	Definition and Method of Plotting
A - Anterior Nasal Spine	Apex of the anterior nasal spine
B - Prosthion	Transition point between the crown of the upper central incisors and the alveolar projection.
C - Infradentale	Transition point between the crown of the lower central incisor and the alveolar projection.
D - Gnathion	Deepest point on the chin.
E - Lower cuspid	The most lateral vertical mid-point of the crown.
F - Lower molar	The most lateral vertical mid-point of the crown.
G - Gonion	The point of intersection between the base and ramus tangents to the mandible.
H - Buttress	Deepest point on the buttress of the maxilla.
I - Upper molar	The most lateral vertical mid-point of the crown.
J - Upper cuspid	The most lateral vertical mid-point of the crown.
K - Zygomatic-frontal suture	The lateral point of the zygomatic-frontal suture.
X - X-line	Through the centre of Crista Galli at right angles to the line joining the two Zygomatic-frontal sutures.

FIGURE 2A

TYPICAL
ANTERO-POSTERIOR
TRACING , AGE 6 YRS.



LANDMARKS

A-ANT. NASAL SPINE

B-PROSTHION

C-INFRADENTAL

D-GNATHION

E-LOWER CUSPID

F-LOWER MOLAR

G-GONION

H-BUTTRESS

I-UPPER MOLAR

J-UPPER CUSPID

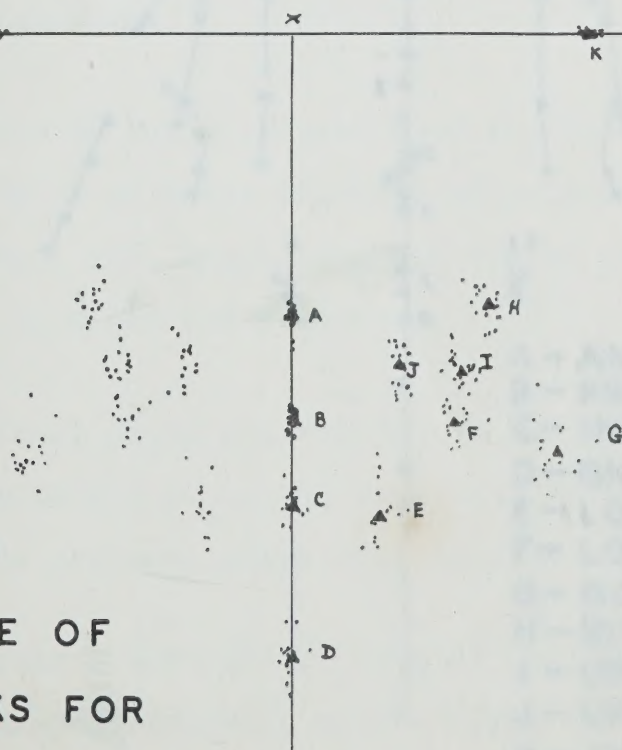
K-ZYGOMATIC-FRONTAL
SUTURE

X-X LINE

FIGURE 2B

COMPOSITE OF
LANDMARKS FOR

CHILDREN AGE 10 YEARS.



Scale x 0.8

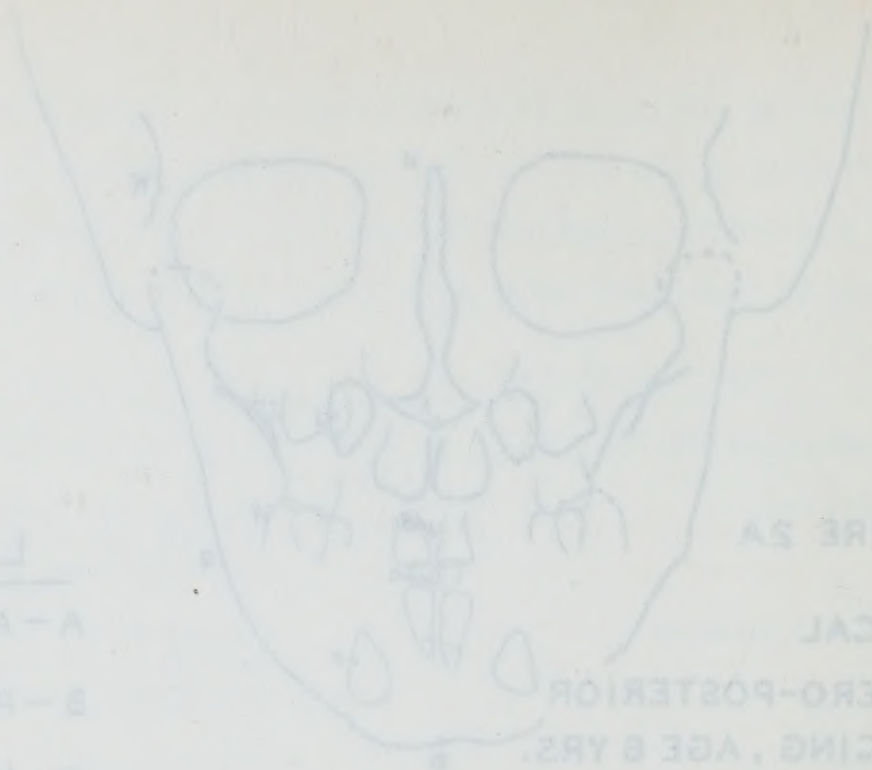


FIGURE 2A

TYPICAL

ANTERO-POSTERIOR

TRACING, AGE 8 YRS.

LANDMARKS

A-ANT. NASAL SPINE

B-PROSTHION

C-INFRA-ORBITAL

D-MENTON

E-LOWER CUSPID

F-LOWER MOLAR

G-GONION

H-BUTTERFLY

I-UPPER MOLAR

J-UPPER CUSPID

K-ZYGOMATIC-ARCH

L-ORBITAL-ARCH

M-X LINE

FIGURE 2B

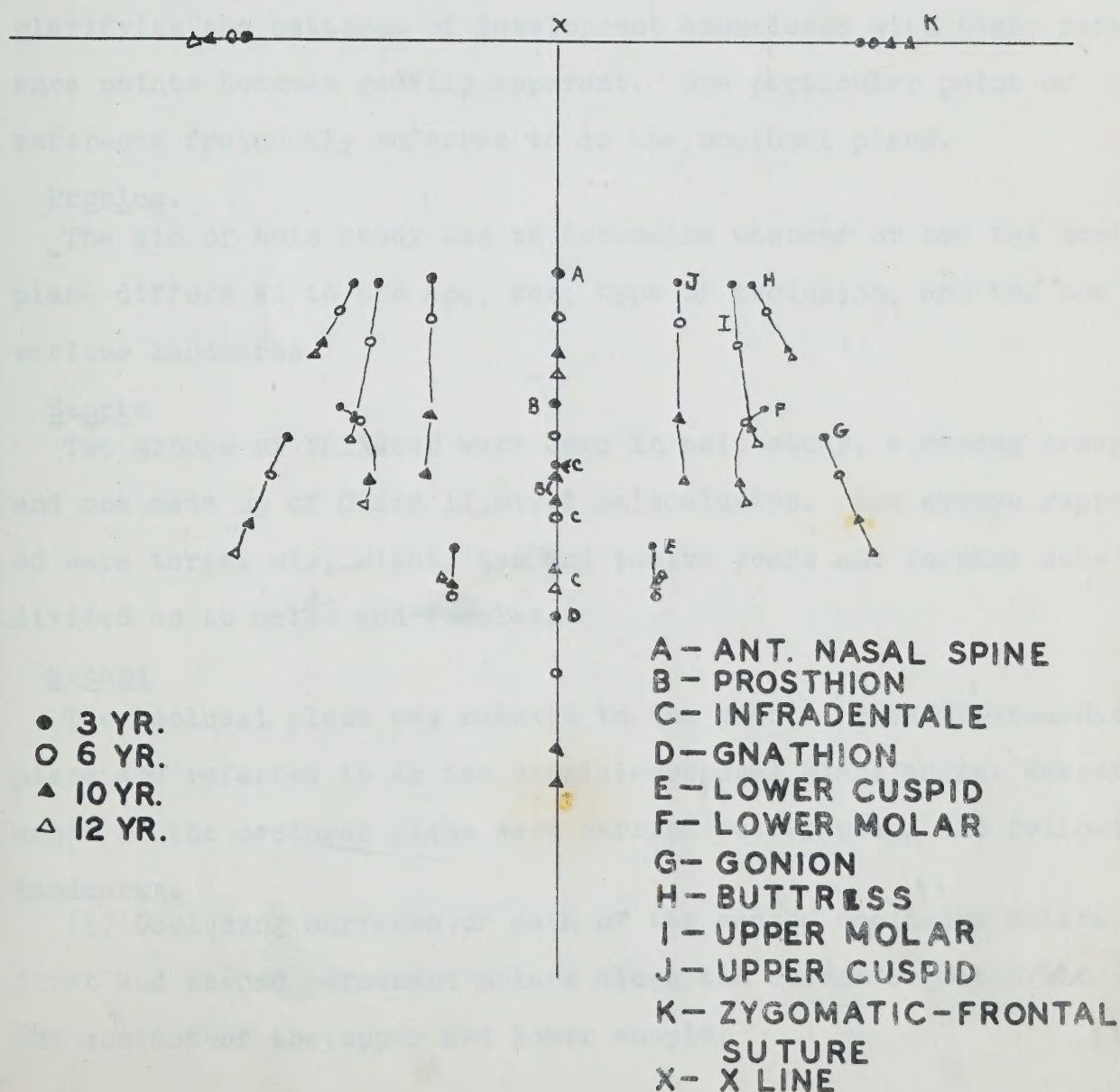
COMPOSITE OF

LANDMARKS FOR

CHILDREN AGE 10 YEARS

FIGURE 2C

PRELIMINARY LATERAL ANALYSIS TEMPLATE



C. Occlusal Plane as related to Age and Occlusion.

Introduction.

In order to determine changes in the growth and development of the facial skeleton use is constantly made of the cephalometric radiograms which are available from the serial and control groups of children. Analyses of these cephalograms are based on certain points of reference. Since the findings of such an analysis are useful in the procedure of diagnosis and treatment planning, the necessity for clarifying the patterns of development associated with these reference points becomes readily apparent. One particular point of reference frequently referred to is the occlusal plane.

Problem.

The aim of this study was to determine whether or not the occlusal plane differs as to the age, sex, type of occlusion, and the use of various landmarks.

Sample

Two groups of children were used in this study, a random group and one made up of Class II, Div. I malocclusion. Age groups represented were three, six, eight, ten and twelve years and further subdivided as to males and females.

Method

The occlusal plane was related to the cranial base (Bolton-Nasion) plane and referred to as the cranial-occlusal plane angle. Measurements of the occlusal plane were carried out by using the following landmarks.

(i) Occluding surfaces of each of the second deciduous molars, first and second permanent molars along the buccal segments through the contact of the upper and lower cuspid.

(ii) Occluding surfaces of each of the second deciduous molars, first and second permanent molars in the posterior and bisecting the overbite in the anterior.

In other words, the last erupted tooth in the arch was used as the posterior landmark. All measurements were made from tracings of the lateral cephalograms to the nearest 0.5 of a degree.

Results

(1) Cranial occlusal angle becomes smaller with age if the same posterior tooth is used over all ages.

(2) Cranial occlusal angle is smaller in the Class II, Div. I group when compared to the random group of children.

(3) Little or no variation is found if the cranial occlusal plane angle is measured at the three developmental stages, that is, upon eruption of the second deciduous molar, first and second permanent molar.

The table will be published when statistical analysis of the data is complete.

D. Facial Type

Study was begun of facial types and their proportions with the objective of deciding if the standard measurements, and subsequent norms which might be produced, differ according to facial type. This phase of the research will be pushed forward as clerical time becomes available. It should be pointed out that the template figure II in Report Series No. 2²¹⁴ is designed to perhaps circumvent the consideration of facial type in developing norms.

E Tooth size

The distribution of combined widths of lower permanent incisors by sex was computed as an aid to clinical diagnosis of which might be called Macrodonia (item T6 in Classification Scheme on page 12). The percentile distribution of this combined measurement from 10-year-olds is given as Data File Table 44.

F Future Basic Research

The groundwork has now been almost completed by gathering the records, classifying them, producing tracings and consolidating measurements so that the amount of future new research is only limited by the time available. However the staff is still largely committed to day by day clinical work so that the staff members can in the practical sense only carry out research as a spare time activity. The policy regarding the use of these data by non-staff members has been set down on page 8 of Report Series No. 1.

DATA FILE TABLE 44

MEDIAN COMBINED WIDTHS (MM.) AND DECILE DISTRIBUTION
OF FOUR LOWER PERMANENT INCISORS BY SEX

Deciles	Females	Males
100	26.4	27.8
90	24.9	25.5
80	24.2	25.0
70	23.9	24.4
60	23.7	24.0
50	23.5	23.7
40	23.3	23.4
30	22.8	23.0
20	22.4	22.9
10	21.9	22.3
0	20.2	20.1

DATA WITH TABLE 44

MEAN COASTING VIBRATION (mm.) AND MEAN DISTRIBUTION
OF TOTAL FORCE VIBRATION (mm.) TO SET

Periods	Periods	Periods
100	100.0	100.0
90	91.0	91.0
80	81.0	81.0
70	70.0	70.0
60	60.0	60.0
50	50.0	50.0
40	40.0	40.0
30	30.0	30.0
20	20.0	20.0
10	10.0	10.0
0	0.0	0.0

DATA FILE

TABLE 44

40 Neutrocclusion Cases: Boys only

Case No.	Tooth Size		Dental Arch		Facial Skeleton			Mand.	
	Rt.	Lt.	Width	Circum.	Max. Lgth.	Mand. Lgth 1	Mand. Lgth 2	Max. W.	Mand. W.
830	11.7	11.7	37	76	52.1	45.1	85.0	70.	83
790	10.5	10.8	38	72	50.7	38.4	82.8	64	79
1376	-	-	37	71	49.7	36.2	77.2	64	75
803	11.3	11.3	36	67	50.7	43.9	81.0	64	84
4	10.2	10.6	38	68	50.8	41.3	79.3	66	93
378	-	-	37	71	52.1	44.5	83.0	64	85
877	11.0	10.6	36	75	54.2	41.8	84.5	66	85
1114	11.0	11.0	39	75	51.2	42.5	81.2	67	88
831	10.3	9.8	38	67	47.5	41.8	80.7	68	87
1135	10.4	10.4	37	71	49.3	39.4	81.7	66	90
205	10.2	10.0	37	70	50.7	41.8	79.2	68	91
370	11.9	11.9	38	75	54.6	44.5	86.5	66	80
1336	-	-	38	74	49.5	43.7	82.3	64	86
1370	-	-	38	72	52.3	43.5	84.6	70	83
1048	11.2	11.2	38	72	49.4	41.0	80.5	69	91
1367	-	-	38	73	51.3	41.9	82.8	68	94
1183	-	-	39	73	52.0	43.5	83.7	69	84
268	-	-	34	66	46.5	41.2	77.4	62	80
405	10.6	10.7	36	73	51.0	42.8	86.2	66	80
846	10.7	10.7	39	75	52.5	45.3	85.1	69	85
540	11.1	11.0	36	74	50	39.4	79.6	66	81
1389	-	-	33	67	53.1	41.3	81.4	61	80
964	10.9	10.8	37	71	51.9	44.3	87.9	67	81
1319	-	-	35	69	50.5	45.0	87.2	66	86
530	9.5	9.6	36	67	47.6	43.8	82.8	64	81
1344	-	-	37	71	51.7	41.0	80.5	65	80
202	10.5	10.6	37	63	49.0	39.8	78.5	66	86
878	11.1	10.8	37	71	55.7	40.9	84.1	66	88
1147	-	-	35	72	51.2	43.2	80.7	64	82
944	10.3	10.0	36	69	51.2	45.0	85.5	65	90
369	10.6	10.8	36	71	52.3	43.5	87.0	63	80
1187	-	-	35	65	48.2	38.5	79.0	62	76
1334	10.4	10.2	39	76	52.2	44.7	84.5	67	88
1307	-	-	39	74	50.2	44.3	82.0	70	85
1209	9.4	9.6	40	71	51.1	40.7	84.0	71	84

(continued)

DATA FILE
TABLE 45

(continued)

Case No.	Tooth Size		Dental Arch		Facial Skeleton				
	Rt.	Lt.	Width	Circum.	Max. Lgth	Mand. Lgth 1	Mand. Lgth.2	Max. W.	Mand. W.
273	10.8	10.3	39	75	55.0	45.0	85.6	68	81
1338	-	-	36	77	53.1	42.0	89.5	67	82
126	11.0	11.5	39	72	53.0	42.0	87.0	70	91
395	10.6	10.6	39	70	50.2	42.8	82.5	67	86
1000	10.9	10.7	41	73	52.1	42.6	81.2	70	83

KEY

Tooth Size = Mesio-distal width of $\frac{6}{6}$

Dental Arch

Width = Distance between $\overline{e/}$ and $\overline{/e}$ at gingival margin just posterior to distal fossae: taken from models.

Circum. = Circumference = Total distance from $\overline{e/}$ to $\overline{/e}$ through contact points: taken from models

Facial Skeleton

Max. L. = Maxillary Length = Distance between PTM and A Point: taken from lateral head plates.

Mand. Lgth 1 = Mandibular Length 1 = Distance between anterior border of ramus and B Point: taken from lateral head plates.

Mand. Lgth 2 = Mandibular Length 2 = Distance between distal border of the condyle and B Point: taken from lateral head plates.

Max. W. = Maxillary Width = Distance between buttresses of maxillae: taken from P-A head plates.

Mand. W. = Mandibular Width = Distance between gonial angles: taken from P-A head plates.

All measurements in mms.

Average age = 6.1 years.

MODELS

[illegible]

BUDGET

1952 - 53	.....	13,790.00
1953 - 54	.....	23,374.95
1954 - 55	.....	18,454.00
1955 - 56	.....	21,912.00
1956 - 57	.....	25,510.00
1957 - 58	.....	25,719.75
1958 - 59	(approved for expenditure)	
Salaries	.....	20,431.65
Travel	.....	700.00
Equipment	.....	360.00
Supplies	.....	3,525.00
Rent and Utilities		2,580.00
Other	.....	1,075.00
Total		<u>28,671.65</u>
		<u>157,432.35</u>

This project has been supported mainly through
National Health Grant Project 605-1-20.

BURLINGTON ORTHODONTIC

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Faculty of Dentistry
University of Toronto, 1959.

CONTENTS

PAGE

Programme of Annual Meeting	1
List of Staff Members	2, 3
Extramural Activities including Lectures and Conferences	4
Records, Treatment, Analysis of Radiograms	6
Definitions of Landmarks and Measurements to be used in the Classification System	11
Demography of Burlington, Population and Status of the Burlington Sample	12
Genetic Studies	23
Special Studies, Numbers 15, 16, 17	28, 29 30
Future Plans	31
Budget	33
Appendix A, the Burlington Orthodontic Research Centre's Exhibit at the American Association of Orthodontists Detroit, May, 1959.	34

PROGRAMME OF
ANNUAL MEETING

439A Brant Street, Burlington

10.00 A.M., December 10, 1959.

- Introductory Remarks (Dr. Gordon Nikiforuk)
- Review of the Year's Work (Dr. Fränk Popovich)
(Dr. Egil Harvold)
- Future Research Plans (Dr. Egil Harvold)
(Dr. Robert Grainger)
- Progress Report on an Analysis of Cranio-Facial Characteristics in Families
(Dr. Margaret Hatton)
- Open Discussion

This publication comprises the fourth in the report series on the
Burlington Orthodontic Research Centre. Public Health Project 605-1-20.

STAFF MEMBERS

This year saw a number of changes in the staff. In April, 1959, Dr.

Frank Popovich retired after directing the Centre for six and a half years.

Although he is now involved in full time private practice, nevertheless, he still maintains close contact with the Centre and is actively interested in its research programme.

The new Director is Professor Egil Harvold, D.D.S., Ph.D., Chairman of the Department of Orthodontics, Faculty of Dentistry, University of Toronto. Professor Gordon Nikiforuk, D.D.S., M.Sc.D., Chairman of Division of Dental Research, continues to be adviser on administrative policy and Associate Professor Robert Grainger, D.D.S., M.Sc.D., Division of Dental Research, retains his position as consultant on research planning and statistics.

In July, 1959, Doctors Stuart Hunter and Allen Feldman joined the staff, Dr. Feldman to work one day and Dr. Hunter three days weekly.

The staff members for the year 1958 - 1959 have been:

<u>Position</u>	<u>Name</u>	<u>Address</u>
Director to April 30, 1959	Dr. Frank Popovich	Burlington
Research Fellow and Clinic Administrator	Dr. Margaret Hatton	Department of Zoology, University of Toronto.
Orthodontic Technician and Secretary	Mrs. Margaret Holbrook	Burlington
Orthodontic Assistant and Stenographer-Receptionist	Mrs. Katharine Scarlett	Burlington
Orthodontists	Dr. Robert Boyko	Toronto
"	Dr. Allen Feldman	Toronto
"	Dr. Stuart Hunter	Burlington
"	Dr. Albert Jarvis	St. Catharines
"	Dr. Malcolm Johnston	Hospital for Sick Children, Toronto.
"	Dr. C. Bruce Morrow	Hamilton
Pedodontists	Dr. W. H. Feasby	Hamilton
"	Dr. Lorne Scott	Brantford

Various members of the staff attended the annual meeting of the American Association of Orthodontists which was held in Detroit, in May, 1959. At this meeting, Dr. Egil Harvold presented a paper entitled "Some Factors Governing Mandibular Morphogenesis" and Dr. Margaret Hatton read a paper on "The Relation between Intra-Alveolar Tooth Movement and Clinical Eruption". An exhibit, prepared mainly by Dr. Margaret E. Hatton and illustrating the Burlington project was presented at the Table Clinic's Section of the meeting. Photographic reproductions of the exhibit are shown in Appendix A of this report.

At the Annual Meeting of the Genetics Society of Canada held in Toronto, March, 1959, Dr. Margaret Hatton discussed "Hereditary Studies in Craino-Facial Development being conducted at the Burlington Orthodontic Research Centre".

An exhibit on the genetic aspects of the Burlington study was prepared by Dr. Margaret Hatton for the Conversation which was held in the Department of Zoology, University of Toronto in March, 1959.

At Ann Arbor, Michigan, Dr. Frank Popovich gave a paper entitled "Orthodontic Diagnosis" to the Easlick Society in April, 1959.

The Toronto Orthodontic Study Club spent a day at the Clinic in April, 1959 at which time various staff members gave informal discussions on different aspects of the project.

The South Western (Ontario) Orthodontic Study Club visited the Clinic in January, 1959 and were given brief discussions of the project by the staff.

Drs. Frank Popovich and Margaret Hatton were elected as consultants to the Research Committee of the American Association of Orthodontists at the Annual Meeting in Detroit in May, 1959. In connection with this work

Extramural Activities (cont'd)

Dr. Hatton presented a paper on "Orthodontic Research and Dental Education".

Drs. Egil Harvold and Robert Grainger attended the second Cephalometrics Workshop at the Bolton Foundation Centre at Western Reserve University, Cleveland in July, 1959.

The Canadian Dental Association sponsored a visit by Dr. Wilfred Feasby to the Philadelphia Centre for Research in Child Growth, in March, 1959, to consult with Dr. W. M. Krogman on methods of analysis of carpal radiograms.

RECORDS, TREATMENT AND CEPHALOMETRIC ANALYSES

Records

Records of individuals taking part in the project include four groups of which the serial and control samples are two. Parents' records constitute the third group and are those not only of serial children but also of twins in the control samples. The fourth group of records are those of siblings of children already enrolled in the clinic, and like the parents' records are being taken for purposes of the genetic investigation.

The practice of taking annual records of the serial cases continues and in order to increase the control sample, the majority of original ~~six~~ year old control group were seen again when the children were nine years old.

The total number of records included in the clinic's files at the end of September, 1959, may be summarized as follows:

I - SERIAL SAMPLE

Age in Years	3	4	5	6	7	8	9	10
Male	142	175	167	158	173	77	41	1
Female	96	132	127	126	133	63	46	

This is one group of children which is seen each year.

II - CONTROL SAMPLE

Age in Years	6	8	9	10	12	
Male	167	96	145	112	116	
Female	136	126	112	107	102	

These are four different groups of children. The nine year old cases are the same children who were seen for the first time when they were six years old.

III - PARENTS RECORDS

Male	116
Female	116

These records are of parents not only of the serial cases but also of twin control cases.

IV Thirty-four cases (23 females and 11 males) have been added to the files to supplement the collection of the family records

Treatment:

The treatment programme includes preventive, interceptive and corrective procedures. The total number of cases included in the programme may be summarized as follows:

TYPE OF TREATMENT

TYPES OF CASES	PREVENTIVE		INTERCEPTIVE		CORRECTIVE			TOTAL
	Fixed Appliance	Removable Appliance	With Appliance	No Appliance	tooth size and Jaw size Discrepancies Discing Extraction	Simple Banding	Removable Appliance	
Active	18	19	14	2	11 25	25	42	156
Deferred because of								
Poor co-operation							3	
Operative Work needed							6	9
Observational								25
Completed								43

Cephalometric Analyses:

Measurements derived from cephalometric radiograms of the complete sample are continually being recorded for the purpose of establishing standards of normal and abnormal growth.

Carpal Index:

From the outset the children's records have included a hand film along with each set of cephalometric films, height and weight records, photographs, history and dental casts. H and films may provide a means of assessing skeletal maturation. An assessment of skeletal age has been described by Dr. Krogman as having direct clinical application in the timing of orthodontic treatment. In addition skeletal age may be pertinent information for a study of normal and abnormal growth patterns.

Therefore to fulfill some of the objectives of this study a standardized technique for assessing hand films was deemed desirable. With this purpose in mind Dr. W. H. Feasby of the clinic staff visited Dr. W. M. Krogman of the Center for Research in Child Growth, Philadelphia, in March, 1959, for guidance on a suitable procedure. Following the visit Dr. Krogman offered to assist in the standardization of film assessment. To this end a sample of films are being evaluated in Burlington following which they will be reviewed by Dr. Krogman. It is intended that this will reduce the possibility of personal variation and bias in the Burlington assessments.

The procedure recommended by Dr. Krogman involves the following significant points:-

1. The evaluator must be familiar with the maturity indicators of the bones of the hand and wrist.
2. The bones are assessed in two groups, (a) carpals and (b) metacarpals and phalanges. This reduces the problem arising from the wide variation of individual bones.

3. The assessment of the film is recorded to show:-

- (a) Sex,
- (b) The standard used, such as Radiographic Atlas of Skeletal Development of the Hand and Wrist, Ed. 1, by Greulich and Pyle.
- (c) The range of assessment; i.e. the two standards between which the sample falls,
- (d) Indicate by underlining the standard closest to the sample, i.e. ~~12~~ - 13
- (e) The net assessment in years and months, e. g. twelve years, nine months,
- (f) Date and the initial of the evaluator.

The standard available to the clinic staff has been Radiographic Atlas of Skeletal Development of the H and and Wrist, Ed. 1, by Greulich and Pyle. During the past year the book's second edition with improved plates has been acquired. Larger (8" x 10") film will replace the 5" x 7" so that adequate films of the older age group may be taken.

Definitions of Landmarks and Measurements to be Used in the
Classification System.

As was pointed out in Report Series No. 3 (pp. 7 - 9) the various types of information which it should be possible to derive from classifying the occurrence of dento-facial characteristics at different age levels will be valuable, not only for purposes of teaching, but also in programmes of case management. Perhaps even more important is the direct application to the Public Health Programme which such a classification provides through epidemiological considerations.

Use of the existing classification system throughout the year revealed that qualitative assessment of certain dimensions within the dentition would be of value. Thus, although the present system has been maintained (pp: 12, 13, Report Series No. 3) much more material is being added to it. The measurements which will be made follow the classic patterns used by many other researchers, including Lundstrom, Seipel, Baume, Brodie and Broadbent. Use of the additional data will be valuable in determining the fluctuations of a series of symptoms amongst growing children, particularly when the year to year maturational change within each individual is analysed. It should be pointed out, however, that the accuracy of the definitions, like the definitions themselves, is not as yet fully determined. This material will be included in future reports.

Figure I



Demography of Burlington Population and the Status of the
Burlington Sample.

The extent of the application of the findings from the Burlington Orthodontic Research Project to various fields of investigation in cranio-facial growth and development is considerable. Because of the research efforts which have gone into this study and because of its basic implications, particularly in problems of epidemiology and thus to the Public Health picture, a critical evaluation of the sample upon which this study is based is quite necessary. It is desirable to know whether or not the sample is representative of the town and also whether or not the community of Burlington is comparable with other communities in the province, with Ontario itself, and indeed the country as a whole. The latter will be considered first.

(A) Burlington Population:

Physical Features of the Town-

Burlington (latitude $43^{\circ} 19'$; longitude $79^{\circ} 47'$) like many other large cities, towns and communities, is situated on the shores of Lake Ontario. (Figure I). Its height above sea level is 268 feet. Serviced by super highways, it is readily accessible and within each reach of Toronto, Buffalo and Rochester. The large industrial city of Hamilton (population 280,000) is but six miles away. Burlington is very attractive. It is not unusual to hear visitors comment not only on this feature, but also on the apparent prosperity of the man on the street. Both in the town and immediately surrounding it are flourishing market gardens and thriving orchards.

The Province of Ontario is divided into seventeen forecast areas, of which "Niagara, Lake Ontario, Toronto and Hamilton" are four with one forecast. Burlington is included in this group of four, the characteristics of which are shown in Table I. This region enjoys much milder winter weather than the

TABLE I

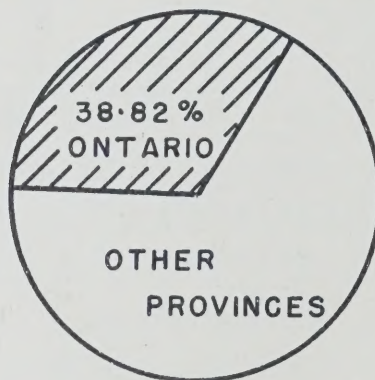
	TEMPERATURE (DEGREES F.)		RELATIVE HUMIDITY. (%)		TOTAL PRECIPITATION (IN.)		DURATION OF BRIGHT SUNSHINE. (HOURS)		WIND SPEED. (M.P.H.)	
	W	S	W	S	W	S	W	S	W	S
MEAN - MAX.	38.7	71.3	81	86	2.72	3.23	179.6	289.4	14.7	10.3
MEAN	32.1	61.9	72	71	2.50	2.66	108.5	231.1	13.5	9.2
MEAN - MIN.	25.3	52.8	55	54	2.29	2.29	69.0	154.3	12.6	8.0

W - DECEMBER TO APRIL INCLUSIVE. i.e. 6 COLDEST MONTHS.

S - MAY TO OCTOBER INCLUSIVE. i.e. 6 WARMEST MONTHS.

MONTHLY VALUES FOR THE STANDARD 30 YEAR PERIOD 1921-1950.
CHARACTERISTICS OF THE WEATHER FOR THE NIAGARA, LAKE ONTARIO,
TORONTO AND HAMILTON REGION.

FIG.2. POPULATION OF ONTARIO
IN RELATION TO THE
POPULATION OF CANADA



northern part of the province (nine forecast areas) including James Bay, Timmins, Kapuskasing, White River, Sudbury, North Bay, Kirkland Lake, Haliburton and Georgian Bay. Summer temperatures in the Burlington region are higher than in northern Ontario. It is worth noting that the total precipitation is about the same for both Northern and Southern Ontario; in the north snow provides most of the moisture, in the south it is rain.

Population Density, Rate of Increase, Racial Background.

The relation between Ontario's population and that of Canada in 1951 is illustrated in Figure 2. Figure 3 indicates that Burlington, with a population of about 6,000 is situated within the region which supports the greater portion of Ontario's population which in turn comprises 40% of the national population. Whatever the factors may be that cause individuals to settle in this part of southern Ontario, they are applicable to this town's inhabitants. Table II shows the area, population and density of population for various regions.

Increases in the population for the town, the county (Halton), the province and the country may be noted in Figure 4 for a ten year period 1941 - 1951. Burlington, like Halton County, was expanding at a greater rate than the province or the country. This would suggest that Burlington and Halton County differ from other parts of Ontario and Canada in being one of the more sought-after areas in which to live.

The four factors just discussed serve not only to describe the town but to compare various physical characteristics with those of other places. The next area of comparison concerns the people themselves who make up this community.

The predominant racial (not ethnic) group making up the Burlington population is Caucasian, the same group to which the majority of people in Ontario belong. Although it is known that some North American Indians, Orientals

FIGURE 3

TABLE II

AREA AND DENSITY OF POPULATION

	LAND AREA IN SQUARE MILES	1951	
		POPULATION	DENSITY
CANADA	3,610,097	14,009,423	3.88
ONTARIO	363,262	4,597,542	12.64
HALTON	362	44,093	121.25
TORONTO	34.66	675,734	19,500.00
BURLINGTON	1.04	2,017	1,939.42

(See Census of Canada 1951)

TABLE II

AREA AND DENSITY OF POPULATION

	LAND AREA IN SQUARE MILES	1951	
		POPULATION	DENSITY
CANADA	3,610,097	14,009,429	3.88
ONTARIO	363,282	4,597,542	12.66
HALTON	362	44,003	121.22
TORONTO	34.88	675,754	19,373.68
BURLINGTON	1.04	6,017	5,785.58

COMPARISON BETWEEN BURLINGTON AND OTHER REGIONS

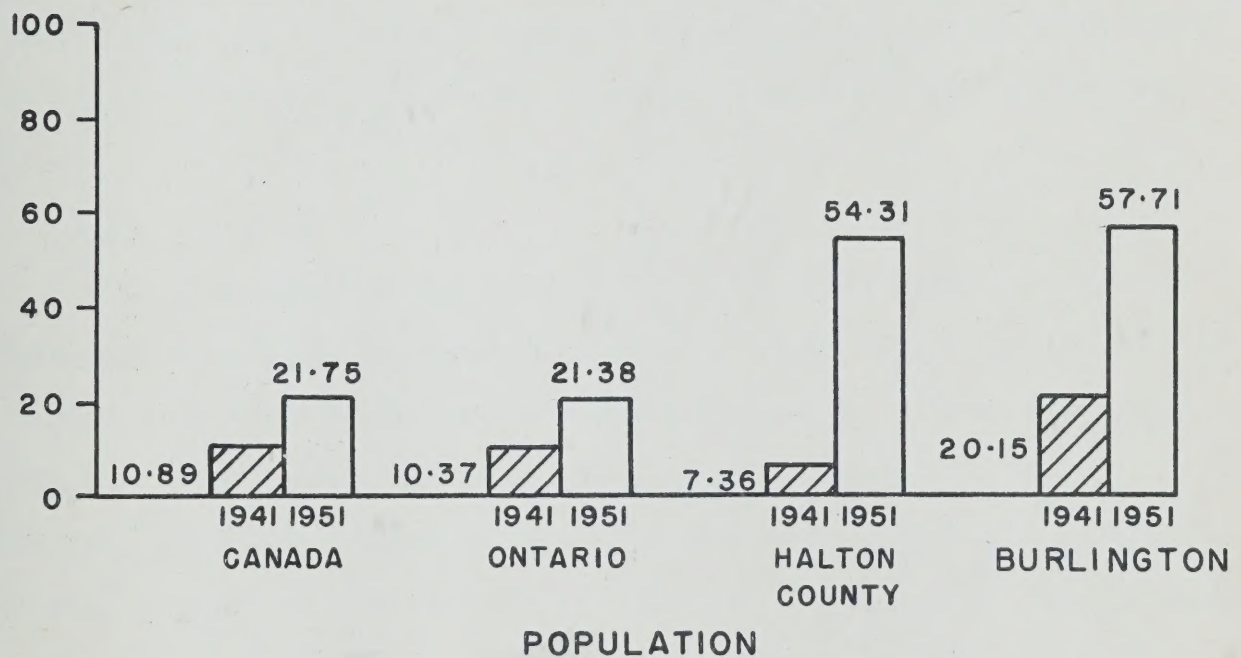


FIG. 4. PERCENTAGE INCREASE OVER PRECEDING CENSUS

and Negroes live in the town, they are so few that through chance they are not represented in the sample.

The number of children in the sample is not large enough to be taken as a basis for comparison with the population of the town, the percentage of children in the sample is 10.7% (Figure 1). The percentage of children in the population of the town is 10.7% (Figure 1). The percentage of children in the population of the town is 10.7% (Figure 1). The percentage of children in the population of the town is 10.7% (Figure 1).

The percentage of children in the sample is not large enough to be taken as a basis for comparison with the population of the town, the percentage of children in the sample is 10.7% (Figure 1). The percentage of children in the population of the town is 10.7% (Figure 1). The percentage of children in the population of the town is 10.7% (Figure 1). The percentage of children in the population of the town is 10.7% (Figure 1).

(a) PERCENTAGE OF CHILDREN IN THE SAMPLE

PERCENTAGE OF CHILDREN IN THE SAMPLE

The percentage of children in the sample is not large enough to be taken as a basis for comparison with the population of the town, the percentage of children in the sample is 10.7% (Figure 1). The percentage of children in the population of the town is 10.7% (Figure 1). The percentage of children in the population of the town is 10.7% (Figure 1). The percentage of children in the population of the town is 10.7% (Figure 1).

Family Size and Age

Throughout the country and the province families of one, two and three are more numerous than those with four, five, six seven and eight siblings. Couples with no children are the most frequent. Burlington is much like the other communities shown in Figure 5.

The number of children in Burlington under fifteen years of age is fewer than in Metropolitan Toronto, the Province of Ontario, and the country as a whole (Figure 6). Probably more significant is the marked similarity between Burlington and the province for the first three age groups which differ from Toronto.

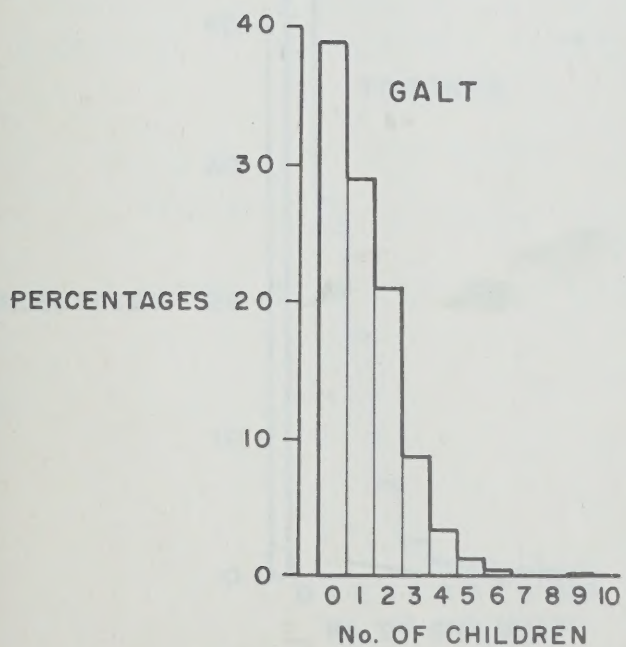
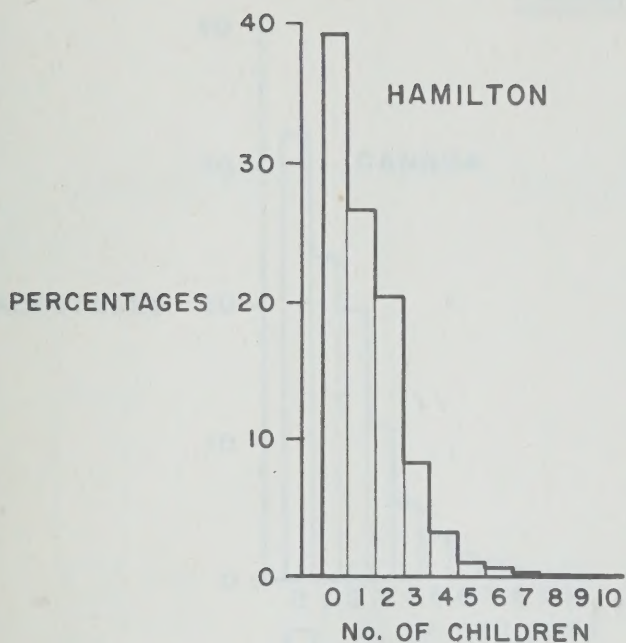
Wage Level

The percentage of wage earners (not the self-employed) for eight different regions is shown in Figure 7. Hamilton and Burlington are the only two communities where the peaks for wage earning capacity lie between \$2500.00 - \$3999.00. For all other regions the greatest percent is between \$2000.00 - \$2499.00. The higher incomes in Burlington must no doubt be due in part to the proximity of Hamilton from which many people, who have managerial type positions, choose to live in Burlington, whereas those with labouring-type jobs tend to live closer to the factories in Hamilton. The histogram of Oakville, another dormitory town closer to Toronto, is similar to that of Burlington.

(B) STATUS OF THE BURLINGTON SAMPLE COMPARED WITH THE TOWN AS A WHOLE

Sampling Methods

A word of explanation is needed regarding the word "sample". The group of children included constitute as nearly as possible all the children in Burlington in 1951-1952 of the ages three, six, eight, ten and twelve years. With the exception of the three year old group the names of the children were obtained from school enrolment lists. The parents of those children were then asked to bring their children to the clinic.



COMPARISON BETWEEN THE
TOWN AND THE SAMPLE
FAMILY SIZE

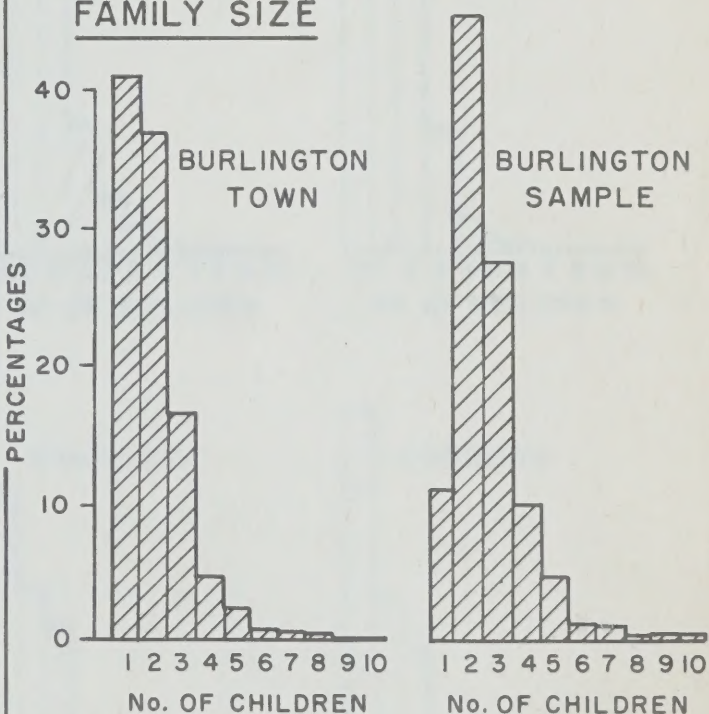
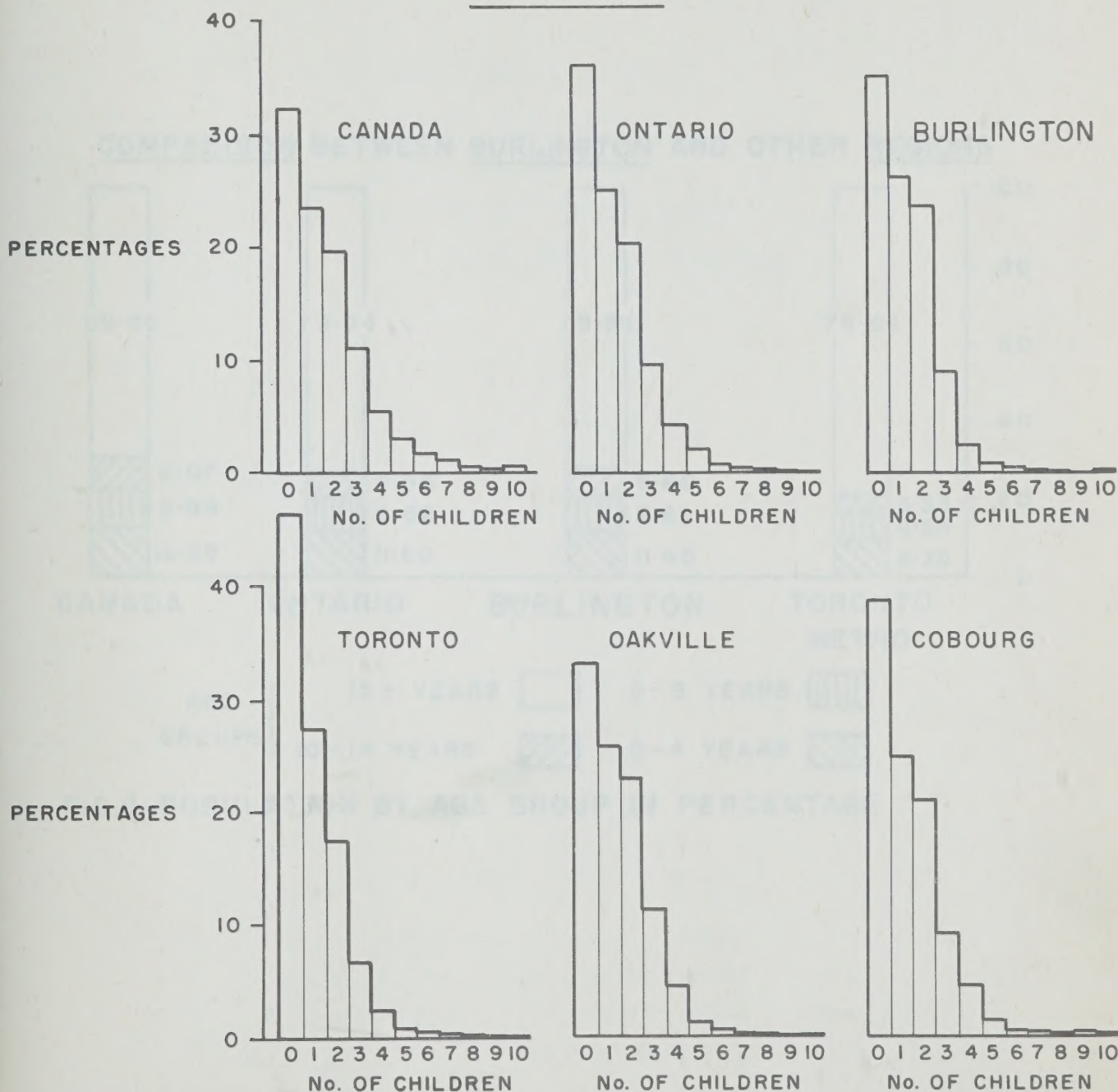


FIG.5. COMPARISON BETWEEN BURLINGTON AND OTHER REGIONS
FAMILY SIZE



COMPARISON BETWEEN BURLINGTON AND OTHER REGIONS

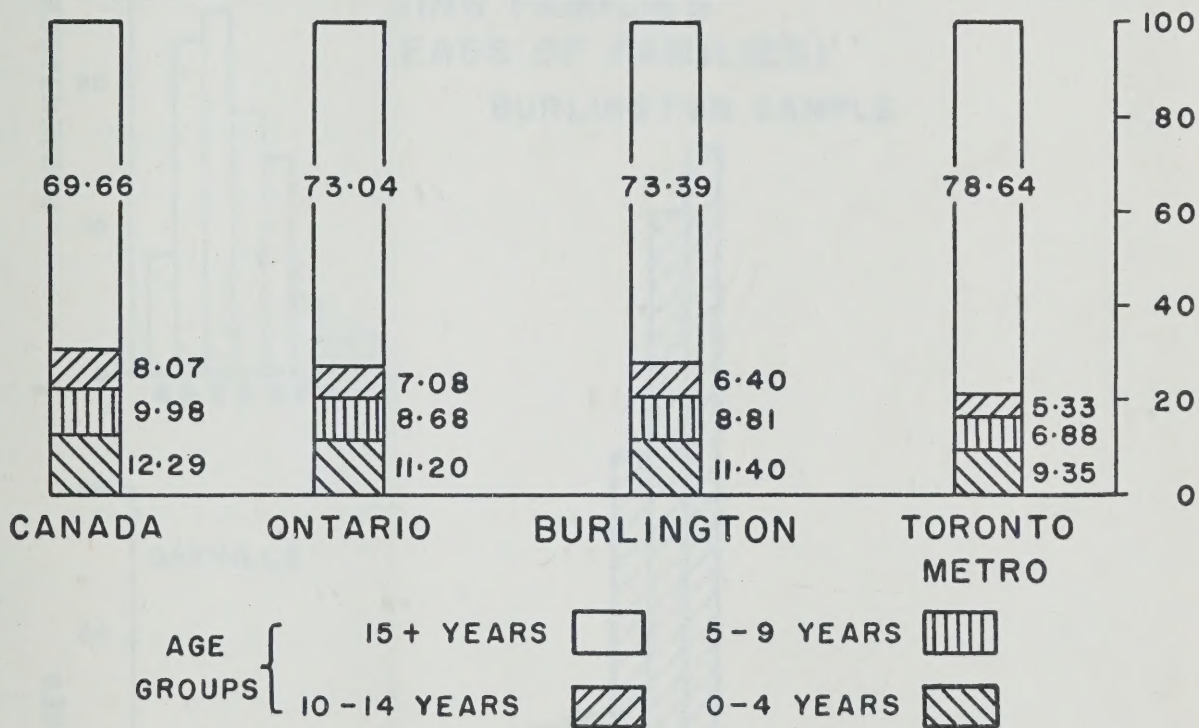
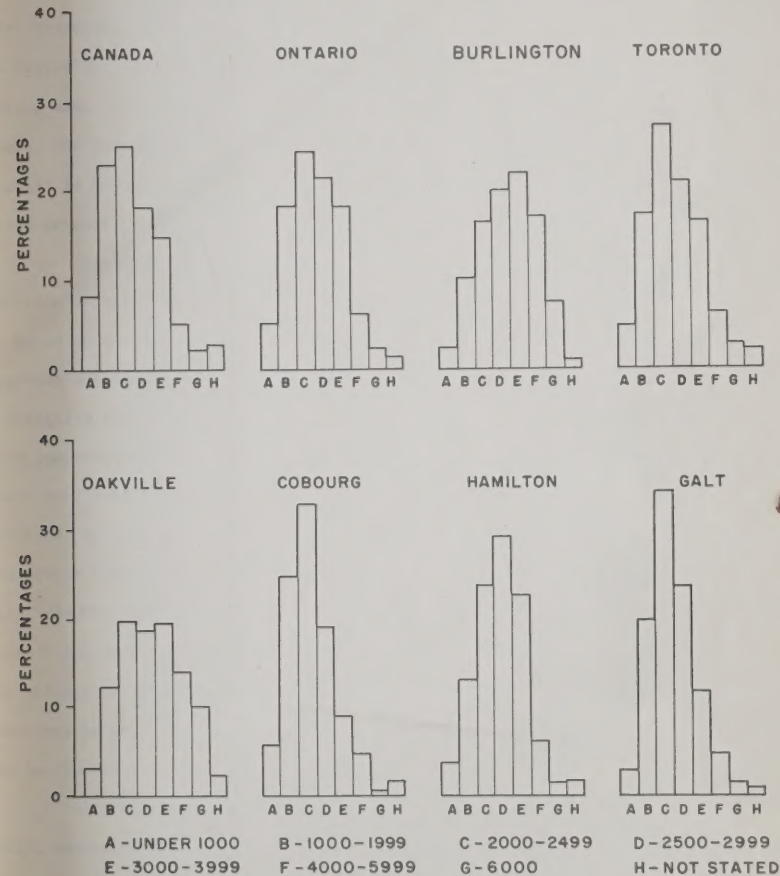


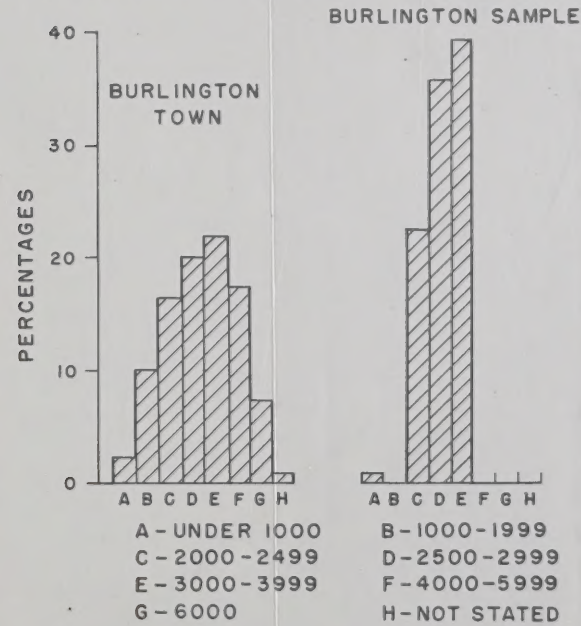
FIG.6. POPULATION BY AGE GROUP IN PERCENTAGE

FIG.7. COMPARISON BETWEEN BURLINGTON AND OTHER REGIONS
WAGE EARNING FAMILIES: (EARNINGS OF HEADS OF FAMILIES)



ALL DATA ARE TAKEN FROM THE 1951 CANADIAN CENSUS. NOTE THAT IN THE GRAPHS AS PRESENTED THE HORIZONTAL SCALE IS IRREGULAR.

COMPARISON BETWEEN THE TOWN AND THE SAMPLE
WAGE EARNING FAMILIES (EARNINGS OF HEADS OF FAMILIES)



The greatest difficulty lay in contacting the pre-school children for whom no lists existed. For this age group, those not included in the study were those who could not be located or whose parents did not wish them to participate. The sample is, therefore, rather an 85% to 90% census of the three, six, eight, ten and twelve year old children residing in the town at that time. The non-responses remained outside the study so that the term "random sample" is not truly applicable even though the study group constituted a very large proportion of the finite population.

The probable bias may be ascertained from the following detailed description of the methods by which people were contacted. The first report was to build up a serial group of three year old children and the most successful approach was found to be through the schools. With permission from the school authorities simple addresses were given to each class in each school informing them comprehensively what the aims of the project were. The members of each class were then asked whether or not they had brothers or sisters of the age required, or if they knew any such children. In this manner nearly 600 children's names were collected, all of which were written down (where possible) with telephone numbers and addresses. On her return to the Clinic from the schools the investigator, Dr. Margaret E. Hatton, either called or wrote to the parents of the children whose names had been noted. Since letters were sometimes ignored, visits to the homes without telephones (including the majority in the new surveys) had to be made.

Although many of the parents contacted did not have a three year old child, nevertheless, this was an excellent means whereby the investigator became acquainted with the parents. It was a result of this contact that the second and third sources of the sample arose.

As a result of conversations and discussions with the parents of pos-

sible three year olds, the investigator was invited to give a number of talks to various groups in the town who were interested in hearing more about the project. These included the Optimists' Club, Lions Club, four different women's groups in the United and Anglican Churches, and three Home and School meetings; two sepearate addresses were given to the local chapter of the I.O.D.E. At these meetings not only were the names of more three year olds submitted but frequently requests were made that older members of the family might be allowed to join the project.

Not long after the initial contact with the parents (both through schools and club meetings), the Clinic started receiving calls from parents who had heard of the study and wished to have their child or children enrolled. Most of these requests had to be refused because the children were either of unsuitable age or else they were not living in Burlington. Between March 1953 and November 1955 the Clinic received an average of three such calls each week. These enquiries served to indicate the widespread interest of the community in the project. After the initial visits to the schools had been made (March 1953) further visits were used both for increasing the serial sample (three year olds) and for collecting the cross-sectional control group, children six, eight, ten and twelve years of age. Whereas the serial cases were children who would be in a long range study receiving orthodontic treatment as the need arose, there was no such inducement for the parents of the control group. The latter were to visit the Clinic only once (as it turned out later, in some cases twice) they were, however, given a consultation service. For the investigator the difficulty in collecting this sample lay not in making the contacts but in convincing the parents of the essential nature of the project and the contribution that their child or children were making by participating.

Initial visits to the schools started in March 1953; by July 1954

the serial sample of children was completed. Assembling the control sample started in November 1953 and was completed in September 1955.

Since this was to be a long-range study, it was obvious that considerable care had to be used in collecting this sample. Each one of the parents taking part was personally interviewed by the investigator. During these interviews not only was the parent told about the project but the dental/orthodontic picture of all their children was discussed as fully as possible. Hereditary problems provided considerable interest for both parent and investigator. Experience has shown that the educational work, though time consuming, helped to ensure the interest and co-operation of the parents and safeguard the future of the whole project.

Finally, some assurance regarding the completeness of the sampling may be obtained from the following 1951 census data;

In 1951 information on number of families in Burlington was as follows:

Total number of families 1651

Total number of couples with no children 587

Total number of families with children over
14 years of age 229

816

Total number of families with children under
14 years of age 835

Two years later when the population of the town had increased the number of families included in the study groups of three, six, eight, ten and twelve year old children was 855. Thus, even with the increase in population accounting for the increase in families over the census number of 835, the number excluded must have been small.

Racial Background

As mentioned under the discussion of Burlington, the most predominant racial type in the town is Caucasian and the study groups turned out to be completely Caucasian except for one Indian family which moved after participating in the project for three years.

Family Size

The number of families with one child in the project is nearly 30% less than the number of families of this size in the town. (Figure 5). The restrictions imposed on the population by nature of the study is obviously the most satisfactory explanation of this disparity. Since three years was the age limit required for a child to take part, there would doubtless have been a number of families with one child under three years. Furthermore, by the time the first child reached three years there would be a very real chance that it would no longer be a one-child family. In both the town and the sample, except for the difference just explained, the general pattern for family size is the same for the study group as the town.

Wage Level

The greatest percentage of wage earners have salaries which fall in the \$3000.00 - \$3999.00 range. This distinguishes Burlington from other Ontario communities and is born out by the salary groups of those in the sample (Figure 7). The individuals taking part in the project seem to be bunched around the three middle brackets, c, d, and e, whereas wage earners in the town, as a whole, are more evenly distributed over the total of categories. This difference may be owing to the fact that the investigation is not a compulsory health programme. A number of well-to-do members of the community, though not all, pointed out that they could well afford orthodontic treatment if their children should need it. Those persons who refused to participate in the project evid-

as mentioned under the discussion of fertility, the most predominant racial type in the town is Caucasian and the study group turned out to be mostly Caucasian except for one Indian family which moved after participating in the project for three years.

Family Size

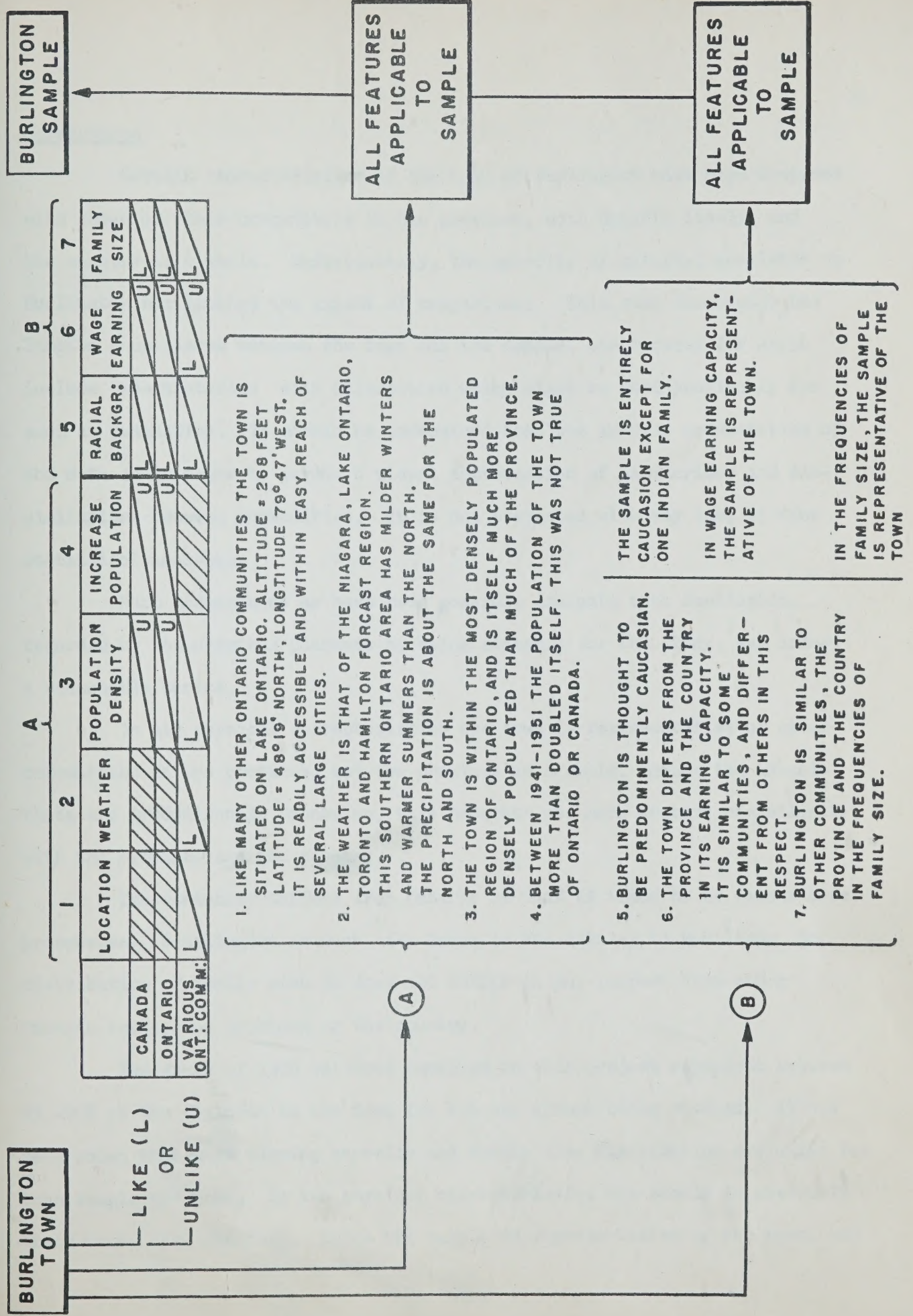
The number of families with one child in the project is nearly 50% less than the number of families of this size in the town. (Figure 2). The restriction imposed on the population by nature of the study is obviously the most satisfactory explanation of this disparity. Since three years was the limit required for a child to take part, those would have been a number of families with one child under three years. Furthermore, by the time the first child reached three years there would be a very real chance that it would no longer be a one-child family. In both the town and the sample, except for the difference just explained, the general pattern for family size is the same for the study group as the town.

Income Level

The greatest percentage of wage earners have salaries which fall in the \$3000.00 - \$3999.00 range. This distinguishes Huntington from other Oklahoma communities and is born out by the salary group of those in the sample (Figure 3). The individuals taking part in the project were to be grouped in the three middle brackets, \$4,000 and \$4,999, \$5,000 and \$5,999, and \$6,000 and \$6,999. These brackets are more evenly distributed over the total of categories. This difference may be owing to the fact that the lower bracket is not a completely distinct bracket. A number of well-to-do members of the community, though not all, pointed out that they would still retain substantial income if their salaries should need it. These persons who retained as professionals in the project were

ently lacked interest in supporting research. As for the indigents, despite the assistance promised them, for the most part, they simply "could not be bothered".

FIGURE .8. SUMMARY



Conclusions

Certain characteristics of the town of Burlington have been compared with those of other communities in the province, with Ontario itself, and the country as a whole. Unfortunately, the sparcity of material available on Burlington has limited the extent of comparison. This same inadequacy has limited comparisons between the town and the sample, the records for which include case histories with information which might be used profitably for such an evaluation. It should be understood that the graphic presentation of the data is in order to permit a visual appreciation of similarities and dissimilarities between communities. It is not presented with any idea of fine statistical analyses.

Such comparisons as have been possible indicate that Burlington, regarded by the original planners as being suitable for the study, was indeed a reasonable choice.

In its physical characteristics the town is representative of other communities in the province, and the province as a whole. Since the inhabitants are predominantly Caucasian, this presents one more feature of similarity with the province and the country.

The community differs from Ontario in that it tends to be rather more prosperous: Burlington is much like Oakville and similar to Hamilton. In distribution of family size it does not differ in any respect from other Ontario towns, the province or the country.

The group of 1300 children enrolled in this project represent between 85 -90% of the children in the town for the age groups being studied. It has been shown that wage earning capacity and family size distribution are alike for both sample and town. In its physical characteristics the sample is obviously bound to be like the town. Since the sample is representative of the town, and

the town, for the most part, is representative of the province, it may therefore be concluded that the findings from the project may be reasonably applied to other Ontario communities.

References

Census of Canada 1951.

GENETIC STUDIES

AN EVALUATION OF HEREDITARY FACTORS IN CRANIO- FACIAL DEVELOPMENT.

The Burlington project, being a long-range serial study, provides an unusual opportunity for observing maturational changes in the same individual. It is clear that from the point of view of the practitioner it is desirable to know not only what changes normally take place as the individual moves from childhood to adulthood, but also what part in those changes is played by inheritance and environment. Such an evaluation requires observations of complete families which may be contrasted with similar observations derived from unrelated individuals. Thus, it becomes clear that such a study involves two basic considerations. First, the normal changes associated with growth must be clarified, and second, genetic versus non-genetic factors must be evaluated. The essential nature of these two considerations cannot be overemphasized. In the view of this writer, the disparity which occurs in the figures currently quoted by various sources for the frequency of malocclusion in the Ontario population, for example, must surely be due to inaccurate diagnosis. A so-called malocclusion may in fact be nothing more than a stage in the normal development of the individual. Moreover, as was pointed out in the last report, an evaluation of hereditary factors is both of anticipatory and prognostic value.

Source of the Sample

(1) Total Sibling Combinations.

A summary of the total number of sibling combinations is shown in Figure 9. This total includes 143 families with at least one sibling in the serial sample. It also includes twenty-seven sets of twins.

(2) Sibling Plus Parent Records.

Since records of the parents of the serial cases are already being collected, for the purposes of this study, i.e. to complete the family's records, it now remains to observe only the other siblings (individuals not so far included in the study in any way) of the "serial case" families.

(3) Twin Sample.

Twenty-seven sets of twins are included in the Burlington Study. Since like-sexed twins with at least one sibling, and preferably a like-sexed sibling, are particularly desirable for this study, the complete family of this type of sibling combination is being observed, even though these may not be a member of the family in the serial group.

Method of Investigation.

Necessity for Keeping Age and Sex Constant.

Unlike a study of eye colour or presence or absence of lateral incisors, studies of maturation, which by their very nature, are characterized by change, require a different sort of analysis. Maturational change is generally (though possibly inaccurately) associated with sex and chronological age. Thus, in attempting to assess the role of hereditary factors in this process, it is necessary to keep age and sex constant. It is now readily apparent why a twin sample of like-sexed individuals with at least one like-sexed sibling is particularly desirable for study; comparisons may be made between twins and other twins, and between twins and their siblings. Collecting sufficient numbers of this type of sibling combination presents certain difficulties. Thus this ideal sample must of necessity be supplemented by non-twin sibling material, organized in the same way.

Use of Classification System.

As may be seen on pages 26,27, the evaluation of a family for cranio-

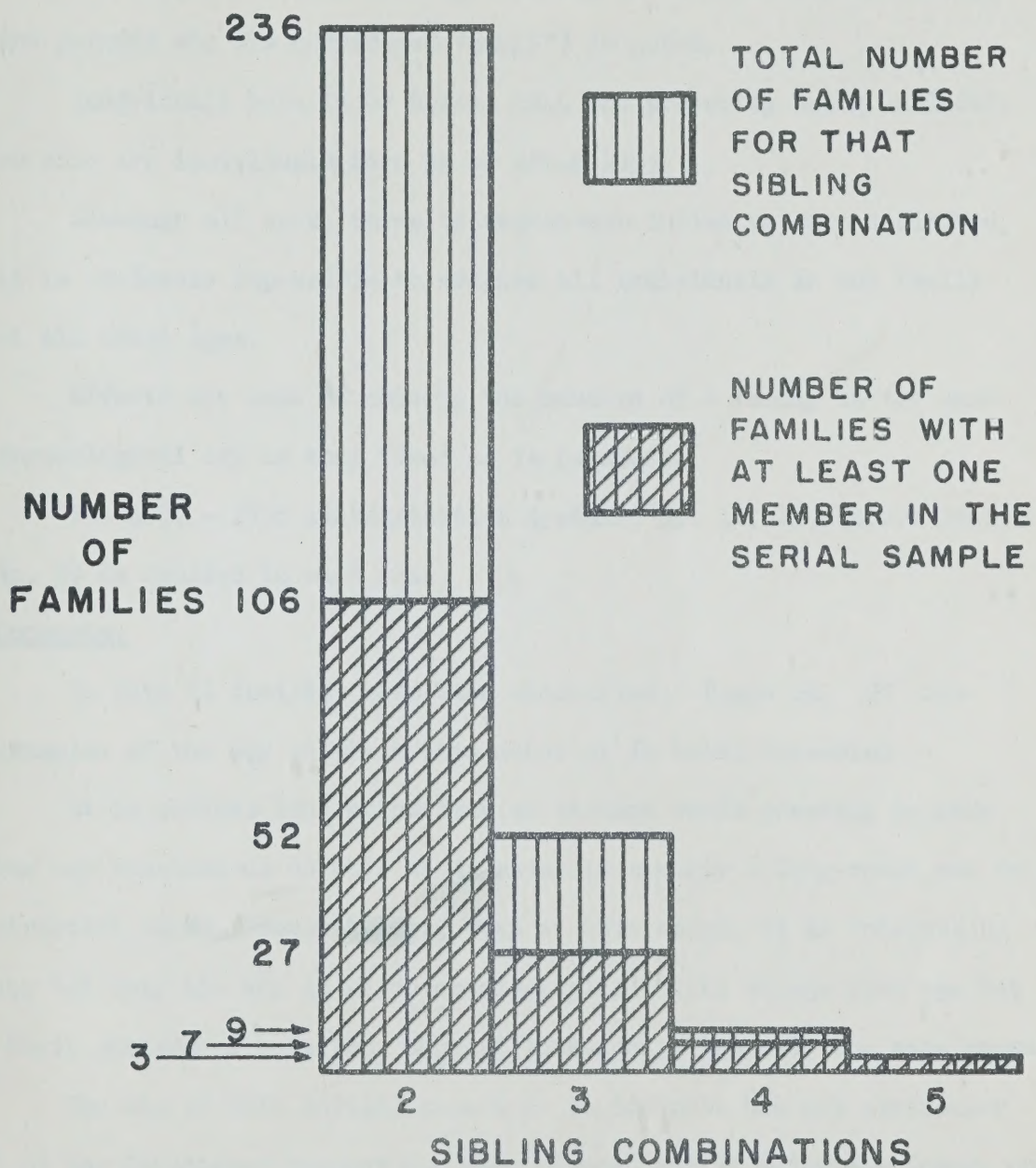


FIG.9. TOTAL NUMBER OF FAMILIES AND SIBLING COMBINATIONS IN THE SAMPLE

Use of Classification System (cont'd)

facial characteristics requires four considerations:

- (1) The complete family with age and sex of each individual (except the parents who are considered "adult") is noted.
- (2) Individuals born in or before 1944 are presently being excluded, so also are individuals born in or after 1953.
- (3) Although all ages, three to twenty-one inclusive, are indicated, it is obviously impossible to compare all individuals in one family at all these ages.

Efforts are made to observe the members of a family at the same chronological age as many times as is possible.

- (4) The 1957 - 1958 classification system (pp. 12, 13, Report Series No. 3) is applied to each case.

Comments.

To date 21 families have been classified. Pages 26, 27 are examples of the way in which this material is being assembled.

It is obvious that at present no attempt could possibly be made to draw any conclusions on this study which is clearly a long-range one in the strictest sense. Nevertheless, even at this stage, it is interesting to note not only the way in which cranio-facial traits change with age but also their pattern of behaviour amongst individuals who have the same parents.

The aim of this initial report is to indicate how one particular facet of the Burlington project has been planned and is being developed. Only slight modifications of the original sample have been made, but the new sample provides the opportunity for a variety of different studies. Moreover, discussions with other researchers concerned with similar problems have led to the conclusion that this study is at present the only one of its type in this field of investigation, mainly owing to the type of records involved and its experimental design.

Experiment 1: The Simple Pendulum

Objective: To determine the acceleration due to gravity (g) using a simple pendulum.

Apparatus: Simple pendulum, stopwatch, meter scale, support stand.

Theoretical Background: A simple pendulum consists of a small mass (bob) suspended by a string from a fixed support. When displaced from its equilibrium position, it oscillates with simple harmonic motion. The period (T) of oscillation is given by the equation:

$$T = 2\pi \sqrt{\frac{L}{g}}$$

where L is the length of the pendulum and g is the acceleration due to gravity.

Procedure: 1. Set up the simple pendulum with a string of length L.

2. Displace the bob slightly and release it to start oscillations.

3. Measure the time (t) for a certain number of oscillations (n).

4. Calculate the period (T) using the equation: $T = \frac{t}{n}$.

5. Repeat the experiment for different lengths (L) and calculate g.

Results: The following table shows the measured values of L, t, and T for different lengths.

L (m)	t (s)	T (s)
0.2	0.9	0.45
0.4	1.2	0.60
0.6	1.5	0.75
0.8	1.8	0.90
1.0	2.0	1.00

Calculation of g: Using the equation $T = 2\pi \sqrt{\frac{L}{g}}$, we can rearrange it to find g:

$$g = \frac{4\pi^2 L}{T^2}$$

Substituting the values of L and T from the table, we get:

$$g = \frac{4\pi^2 \times 0.2}{(0.45)^2} = 9.8 \text{ m/s}^2$$

Conclusion: The acceleration due to gravity (g) is determined to be 9.8 m/s².

Precautions: 1. The pendulum should be set up in a vacuum to avoid air resistance.

2. The bob should be a small, heavy mass to minimize the effect of air resistance.

3. The string should be inextensible and the support should be rigid.

4. The oscillations should be small (less than 10 degrees) to ensure simple harmonic motion.

5. The stopwatch should be started and stopped accurately.

Cranio-facial characteristics

[illegible]

(continued from previous page)

Approximate values

100 90 80 70 60 50 40 30 20 10

100 90 80 70 60 50 40 30 20 10

100 90 80 70 60 50 40 30 20 10

100 90 80 70 60 50 40 30 20 10

Cranio-facial characteristics

[illegible]

in families

age of observation

yrs. 14 15 16 17 18 19 20 21 adult

VN
0
0
N, 1, 5

Special Study Number 15.Mandibular Morphology and Eruptive Sequence of Bicuspid and Cuspid

Investigators: John Bimm, Douglas Eisner and Carlos Ibanez.

Problem: It has been shown that pathologic variations of the maxilla can alter mandibular morphology. The aim of this proposed study is two-fold; to reassess the degree of change in mandibular morphology which may be produced by severe disturbance in maxillary form; second, to estimate the possible effects of altered morphology on the formation, rate and sequence of eruption of the mandibular cuspids and bicuspid.

Sample: Both right and left oblique cephalometric radiograms of each individual from two samples will be studied. The six, eight and ten year old children from the Burlington Centre and those of similar age from the Cleft Palate and Cleft Lip Clinic of the Hospital for Sick Children, Toronto, will constitute the two samples. Though surgically treated the children from the Hospital have received no orthodontic therapy.

Method of Investigation: Variations which occur in mandibular morphology and their possible effects on eruption will be determined from the pathological conditions presented by the cleft lip and cleft palate cases. In contrast to these selected cases will be those presented by the Burlington sample, individuals which are representative of the population. The latter group will therefore be used as a control with which comparisons of the affected individuals may be made.

Special Study Number 16.The Cranial Base and Cervical Vertebrae in Cleft Palate and
Normal Individuals.

Investigator: R. B. Ross

It has been held that an important factor, perhaps the primary factor, in the etiology of cleft lip and palate is a variation in the morphology of the structures separating face from brain. The purpose of this study is to compare the relations of each component of the cranial base in the cleft individual to the non-cleft. In addition, congenital anomalies of the cervical vertebrae will be compared as to incidence, type and degree of severity in both groups. Emphasis will be on relating the data gathered to embryological development.

Cephalometric roentgenograms for 350 cleft children have been collected from the files of the Cleft Palate Research and Treatment Centre of the Hospital for Sick Children in Toronto. Cephalometric roentgenograms of 200 children from the Burlington Orthodontic Research Centre will be used as controls for the cranial base measurements, while 850 will be used for the cervical anomaly control. Linear and angular measurements, as well as qualitative analyses have been gathered from this material.

The study has been partially supported by a studentship grant from the Canadian Dental Association.

Special Study Number 17.An Investigation Into The Growth and Development of The Upper
Facial Skeleton In Cleft and Non-Cleft Palate Children.

Investigator: T. B. Coupe

In this study it is intended to investigate some of the differences that occur in the upper facial skeleton from a comparison of cleft and non-cleft palate children. Particular attention will be paid to the growth and development of the maxillae and the significance, if any, of the nasal septum in this process.

Cephalometric x-rays both in the lateral and frontal positions will be used for this purpose. The x-rays of the cleft-palate children will be obtained from the records of the Cleft Palate Research and Treatment Centre of the Hospital for Sick Children, Toronto. X-rays from the files of the Orthodontic Research Centre, Burlington will be used as being representative of a similar population of non-cleft palate children. The number of cases to be used in each sample will be approximately 400.

This study is being supported by a research fellowship held at the Research Institute of the Hospital for Sick Children, Toronto.

Future Plans

Clinical Routine:

The practice of taking annual records of the serial sample, which now includes 250 children, will be continued. The total number of cases undergoing (active) orthodontic therapy is 118. Preventive, interceptive and corrective measures will be taken for patients showing malocclusion symptoms.

Starting in November, 1959, a new control group will be added to the files. This will be made up of the original ten year old and twelve year old control samples which will be observed as the children reach sixteen years of age. These cases will provide non-treatment controls and also present additional information on the frequencies of malocclusion at this advanced stage of the permanent dentition.

General Research Programme:

The entire sample (serial and control groups) is to be classified according to the system described on pages 12 and 13 of Report Series No. 3 and page 11 of the present report. It is anticipated that this procedure will take approximately two and a half years. The data which are presently being accumulated on preventive-interceptive procedures serve to indicate that the cases involved in this programme will have to be treated and observed for ^{more} several years/before valid conclusions on the efficacy of the procedures may be established.

Data derived from cephalometric radiograms will continue to be accumulated and analyses of the carpal radiograms will be determined.

(Future Plans cont'd)

Hereditary Factors in Cranio-Facial Development:

Complete family records will continue to be collected and classified. Although certain analyses of this material may be made within the coming year the study will be considerably more valuable in 1967.

Studies in Cranio-Facial Morphology:

Studies of mandibular morphology and the effect of the latter will be developed and expanded. (See pages 67 - 80 Report Series Number 3).

Future studies which are described on pages 28, 29 and 30 of the present report serve to illustrate some of the research possibilities which are presented by the combination of the Burlington material and that of the Cleft Lip and Cleft Palate Clinic at the Hospital for Sick Children in Toronto.

Budget.

1952 - 53	13,790.00
1953 - 54	23,374.95
1954 - 55	18,454.00
1955 - 56	21,912.00
1956 - 57	25,510.00
1957 - 58	25,719.75
1958 - 59	28,671.65

1959 - 60 (approved for expenditure)

Salaries 21,425.00

Travel 806.50

Supplies 3,525.00

Rent and Utilities 2,630.00

Other 1,075.00

Total \$29,461.50

29,461.50

\$186,893.85

This project has been supported mainly through

National Health Grant, Project 605-1-20.

Appendix A. The Burlington Orthodontic Research Centre's Exhibit
as Presented at The Annual Meeting of the American
Association of Orthodontists - Detroit, May, 1959.

In November, 1958, the Department of Orthodontics, University of Toronto, received a request from Dr. Edward Cheney, Chairman of the Table Clinics and Exhibits Section of the American Association of Orthodontists that an exhibit illustrating the research being conducted at the Burlington Orthodontic Research Centre should be presented at the annual meeting of that organization in Detroit in May, 1959.

The sample upon which the Burlington Research is being conducted is generally regarded as an unselected group of children representing their age level for the town. In contrast to this group is that which is being studied at the Cleft Lip and Cleft Palate Clinic of the Hospital for Sick Children, Toronto. These children, by nature of their defect, form a highly selected sample. Thus, these two studies serve to supplement each other, one group representing pathological conditions of growth, the other the normal changes of maturation. However, the organization of both projects, including the type of records being taken, makes comparison quite feasible.

Since the possibilities for research[#] presented by these two projects are both extensive and unique, it was the opinion of Dr. Egil Harvold, Chairman of the Department and Director of the Burlington Clinic, that if a display were to be presented it should include both studies. Furthermore, since the Department of Orthodontics represents the teaching centre for both projects it was felt that a contribution should also come from this source.

See pages 28, 29 and 30.

Under the supervision of Dr. Egil Harvold, the entire exhibit was planned, organized and executed by Dr. Margaret E. Hatton, Burlington Orthodontic Research Centre, and Dr. Malcolm Johnston, Hospital for Sick Children. The contribution from the Department of Orthodontics, University of Toronto, was submitted by Doctors Donald Woodside and Ross Fisk. The artists in the Department of Visual Education at the Hospital for Sick Children assisted with the illustrations but the main body of the work including all the lettering was the effort of Mr. James Trigg, free-lance artist, Weston, Ontario. Criticism and suggestions were made by the staff of the Burlington Centre including Dr. Bruce Morrow, who made much of the equipment used.

The exhibit was started in January, 1959, and was completed four days before it was taken to Detroit. On April 29th it was displayed in the Dental Building of the University of Toronto, where other Faculty members including Dr. Roy G. Ellis, Dean of the Faculty of Dentistry, came to see it.

As may be noted, this exhibit summarizes in all their variety, the fields of investigation with which both projects are concerned. This is the first time that any attempt has been made to draw these two studies together as a basis for comparison and contrast in the characteristics of growth. As evidence of the contribution which it is possible that both projects, in combination, are capable of making toward solving the problems of maturation, it was considered significant that this exhibit should be brought to the attention of all the members of the American Association of Orthodontists.

The display is now permanently housed in the Dental Building of the Faculty of Dentistry, University of Toronto, where it will not only be used

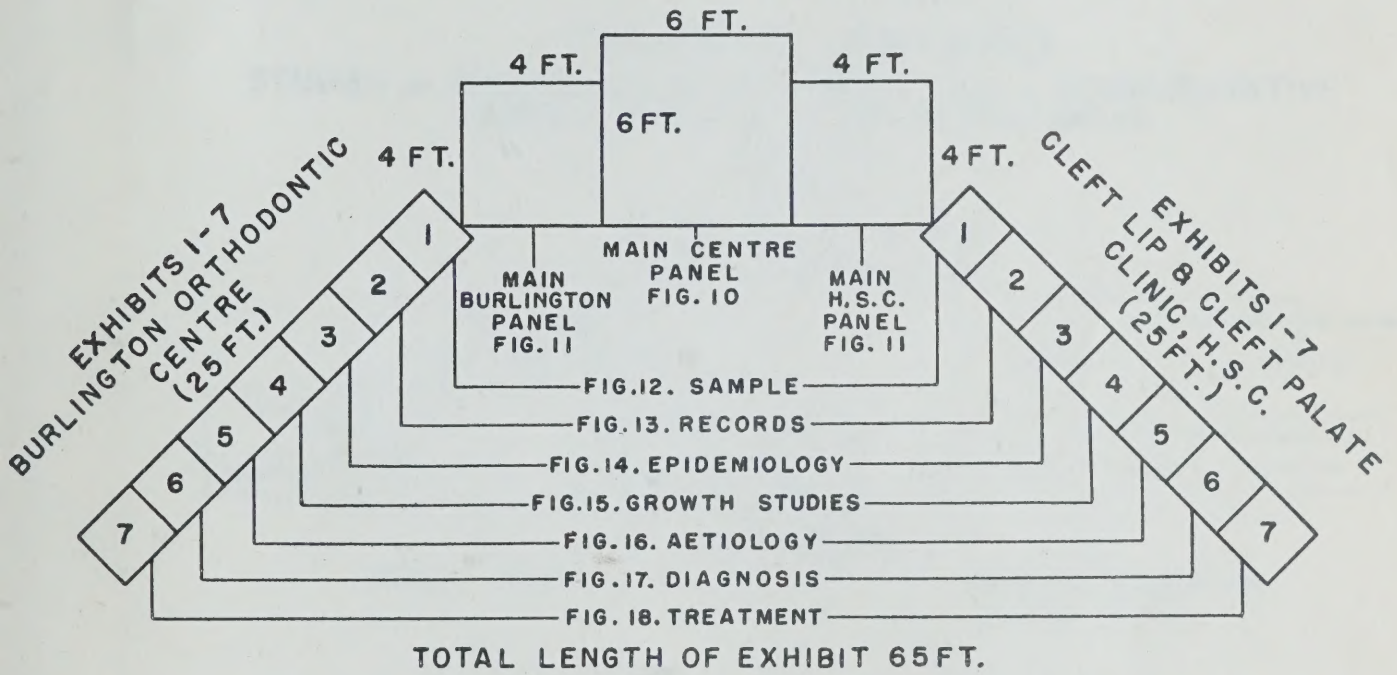
for purpose of teaching, but also be included in other exhibits.

(For example, part of the exhibit is being used in the Mediscope Exhibition presented by the Ontario Medical Association, from October 12 - 17, 1959).

RECEIVED BY LIBRARY - DETROIT MAY 1959



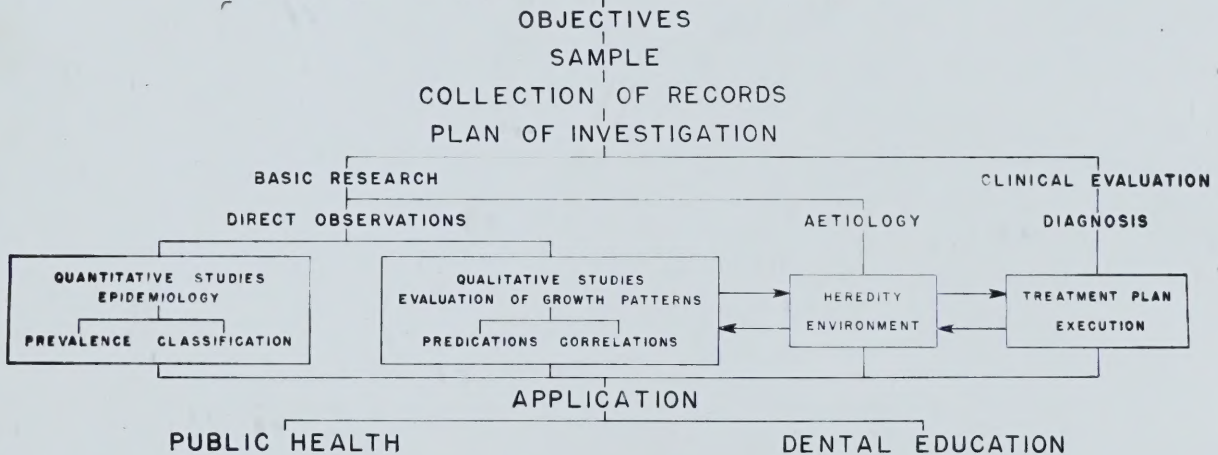
GENERAL PLAN OF EXHIBIT - DETROIT, MAY 1959



MAIN CENTRE PANEL

(Upper Portion)

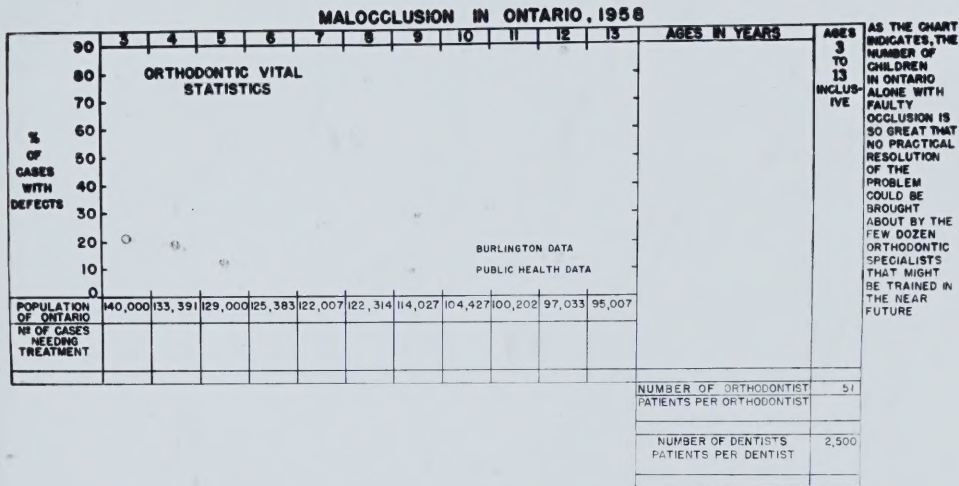
TORONTO, ONTARIO.
STUDIES OF GROWTH AND DEVELOPMENT FROM A REPRESENTATIVE
SAMPLE COMPARED WITH A SELECTED GROUP



MAIN CENTRE PANEL

(Lower Left)

Public Health

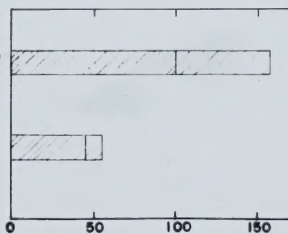


CLEFT LIP AND CLEFT PALATE IN ONTARIO

TREATMENT (ORTHODONTIC & PROSTHETIC)
REQUIRED vs. TREATMENT AVAILABLE AT
THE CLEFT PALATE RESEARCH &
TREATMENT CENTRE, HOSPITAL
FOR SICK CHILDREN.

AVERAGE NUMBER OF CASES OF
CLEFT LIP AND/OR CLEFT PALATE
BORN PER YEAR.
[] 1940-53 (PRESENT WORK LOAD)
[] 1957-58 (FUTURE WORK LOAD)

NUMBER OF CASES COMPLETING
ORTHODONTIC TREATMENT AT
CENTRE PER YEAR.
[] 1958 (PRESENT RATE)
[] (ESTIMATED FUTURE RATE)

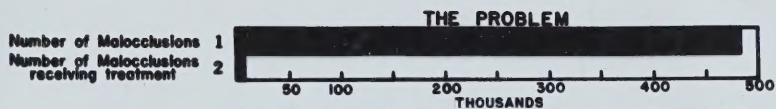


Although the centre is capable of treating a large proportion of the present number of cleft lip-cleft palate children in Ontario, it is impractical from a service point of view (travel considerations etc.) to expand in order to cope with the rapidly increasing population. However, the treatment of relatively large numbers is permitting detailed studies of facial growth, orthodontic treatment and prosthetic retention-all of which assist in placing the dental habilitation of the cleft lip-cleft palate child on a more sound and practical basis. This, in turn, will enhance greater decentralization of services to centres in smaller communities and to private practitioners.

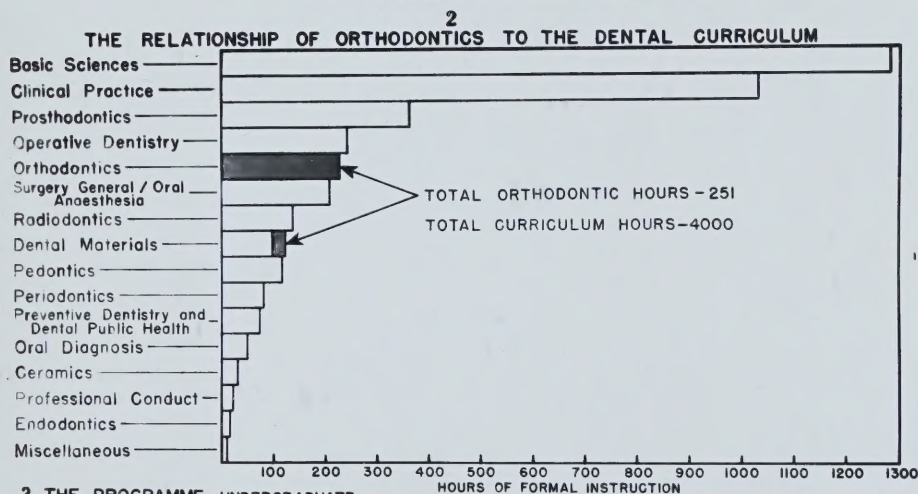
MAIN CENTRE PANEL

(Lower Right)

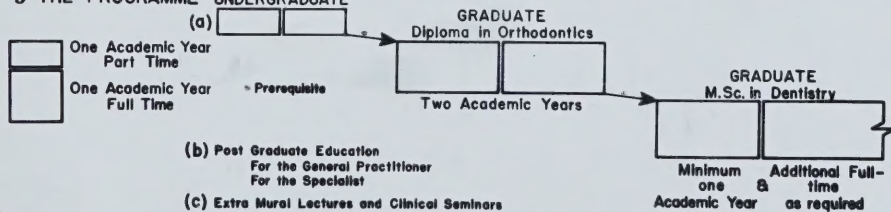
Dental Education



1—NUMBER OF MALOCCLUSIONS IN ONTARIO CHILDREN, AGES 4-14 YEARS.
2—ESTIMATED NUMBER OF MALOCCLUSIONS THAT COULD BE TREATED BY ORTHODONTISTS IN ONTARIO DURING 1959.



3 THE PROGRAMME UNDERGRADUATE



UNIVERSITY of TORONTO BURLINGTON ORTHODONTIC RESEARCH CENTRE *

OBJECTIVES To study in a *REPRESENTATIVE GROUP* of *CHILDREN* :-
The *CHARACTERISTICS* of cranio-facial *GROWTH* and *DEVELOPMENT*
The effects of *HEREDITY* and *ENVIRONMENT* in governing this growth and development.
The efficacy of *PREVENTIVE-INTERCEPTIVE* orthodontic *THERAPY*.

SAMPLE 1300 children between the ages of *THREE* and *TWELVE* years of age representing 85%-90% of the population of the town (in the age groups employed) are included in the sample *EXHIBIT I*

RECORDS Four main types of records are being assembled. These are *RADIOGRAMS* dental *MODELS*, *PHOTOGRAPHS* and case *HISTORIES*. *EXHIBIT II*

PLAN OF INVESTIGATION BASIC RESEARCH

EPIDEMIOLOGICAL STUDIES

A *CLASSIFICATION* system has been established which employs *DIRECT OBSERVATION* rather than any extrapolation technique.

The *PREVALENCE* of various defects at various ages has been determined. *EXHIBIT III*

DETERMINATION OF GROWTH PATTERNS

Records both serial and cross-sectional provide the opportunity for a variety of investigations. *PREDICTIONS* and *CORRELATION* values are presently being considered. *EXHIBIT IV*

AETIOLOGICAL EVALUATION

In order to clarify *HEREDITARY* and *ENVIRONMENTAL* factors, the advantages of a *SERIAL STUDY* which includes *LIKE-SEXED TWINS* and their *LIKE-SEXED SIBLINGS*, are illustrated. Observations of *FAMILY PEDIGREES* provide information on the *MODE* of *INHERITANCE* of certain traits.

The *INFLUENCE* of *ENVIRONMENTAL* factors is also shown. *EXHIBIT V*

CLINICAL EVALUATION

DIAGNOSIS

RESEARCH into *DIAGNOSTIC METHOD* is being conducted, meanwhile no conventional system of diagnosis is being employed. *EXHIBIT VI*

TREATMENT

PREVENTIVE TREATMENT consists of fixed and removable space maintainers, monoblocks and labio-lingual type of appliances. *EXHIBIT VII*

* This project is financed by the Department of National Health and Welfare and is administered by the Faculty of Dentistry, University of Toronto.

DIRECTOR: Dr. F. Popovich D.D.S. M.Sc. GENETICS: M. Herton Ph.D. STATISTICS: Dr. R. M. Grainger M.Sc.

HOSPITAL FOR SICK CHILDREN. TORONTO, ONTARIO.
THE CLEFT PALATE RESEARCH AND
TREATMENT CENTRE *

OBJECTIVES To investigate, in *INDIVIDUALS* with *CLEFT LIP* and/or *PALATE* :-
The *CHARACTERISTICS* of cranio-facial *GROWTH* and *DEVELOPMENT*.
The influence of *GENETIC* and *ENVIRONMENTAL* factors.
The potential contribution of *ORTHODONTIC TREATMENT* in modifying abnormal growth patterns.

SAMPLE To date the sample consists of 600-700 cleft lip and/or cleft palate individuals between the ages of *FOUR* and *SEVENTEEN YEARS*. It is presently being supplemented by infant material. *EXHIBIT I*

RECORDS *CEPHALOMETRIC RADIOGRAMS* and *CASE HISTORIES* have been taken of the complete sample; *MODELS* and *PHOTOGRAPHS* are also available for individuals who have received orthodontic treatment. *PRE-SURGICAL* and *SURGICAL DATA* are also recorded. *EXHIBIT II*

PLAN OF
INVESTIGATION
BASIC RESEARCH

EPIDEMIOLOGICAL STUDIES

The *INCIDENCE* of clefts, cleft types, associated anomalies and specific occlusal defects is being investigated. Methods of *CLASSIFICATION* are being developed. *EXHIBIT III*

MORPHOLOGICAL STUDIES

PATTERNS of *GROWTH* and *DEVELOPMENT* are being investigated on *CROSS-SECTIONAL* and *SERIAL DATA*. The *BURLINGTON RECORDS* and *UNAFFECTED SIBLINGS* are being used as *CONTROLS*. *EXHIBIT IV*

AETIOLOGICAL STUDIES

The interaction of *GENETIC* and *ENVIRONMENTAL* influences in the production of dento-facial anomalies is indicated *EXHIBIT V*

CLINICAL EVALUATION

DIAGNOSIS

The use of *CEPHALOMETRIC RADIOGRAMS* and other information as *DIAGNOSTIC* aids is presented. *EXHIBIT VI*

TREATMENT

ORTHODONTIC MANAGEMENT peculiar to cleft palate, problems related to *RETENTION* and possibilities of *PRE-SURGICAL* reduction of deformity are illustrated. *EXHIBIT VII*

* This Centre is financed by the Atkinson Charitable Foundation and is administered by the Research Institute of the Hospital For Sick Children.

DIRECTOR: Dr. M. Johnston M.Sc.

~~OVERNIGHT BOOK~~

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FACULTY OF DENTISTRY

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